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ABSTRACT

Papers on information technology, which were presented at the 1983 International Federation of Library Associations (IFLA) conference, include: (1) "Automation's Impact on (Information) Users" by Arja-Riitta Haarala (Finland); (2) "Economics and Politics of Information Technology: Some Trends in Its Application to Information for the Professional," in which John R. U. Page (Austria) describes the impact on libraries of online searching and electronic document delivery; (3) "NEWWAVE: The On-Line Cataloguing System of the Royal Library in Brussels" by Guido C. Goedeme and others (Belgium); (4) "Impact of Technology on Librarians," in which George K. Thompson (Switzerland) suggests that technology has created new information requirements, a shift in library role, and the need for librarians who can adjust to constant change; (5) "Advancing Technology: The Secondary Impact on Libraries and Users," in which Donald B. Simpson (United States) looks at the effect of advancing computer and telecommunications technology on library buildings, on the role of libraries in society, and on the preservation of library materials; (6) "Der Einfluss zukunftiger Informationstechniken auf die Beziehung zwischen Mensch und Maschine (The Influence of Future Information Technologies on the Relation between People and Machines)" by W. Heimann (paper in German); (9) "Some Possible Future Effects of Information Technology" by Maurice B. Line (United Kingdom); and (10) "Overview: The Impact of Technology on Libraries," a review by Henriette D. Avram (United States) of the impact of technology on people (both library staff and users) and their environment. (ESR)

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Automation's Impact on Users

by

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AUTOMATION'S IMPACT ON USERS

I have been asked to talk to you today on the impact of automation on users. Over two decades we have used automation and talked about future technology. The future reached us some time ago. We have all come into contact with this new information technology: activities and operations have to be automated in order to get them done. New information technology has become an integral part of our everyday work. Along with automation we have become more aware of the problems and consequences we encounter at the present time and will encounter in the future. This can also be seen in the literature published concerning automation. It has been dominated by technology oriented papers because new techniques had to be developed and applied in practice. Recently, increasing attention has been paid to the human side of the question — both the social risks and the benefits of automation to users.

At the IFLA Seminar one natural restriction is that we discuss automation in libraries. However, I have interpreted libraries as a part of a wider system that includes all the components which make up an information system. The whole chain, including information producers — such as authors and scientists —, database producers, telecommunication networks, service suppliers and hosts, as well as intermediaries and librarians and also users should be seen as one big system and dealt with when considering the impact of automation.

This paper arises from the automation environment that can be found in libraries and information services, especially in science and technology libraries. The topics I mention and the views I express are bound to be coloured with automation applications I have experienced. Therefore I shall first briefly review automation applications in libraries to enlighten the environment, and then go on to matters I find important in connnection with the impact of automation on users.

The Environment Influenced by Automation in Libraries

The increasing availability of large computerised databases has, for several years, served as an indicator to libraries that a greater change in providing information is forthcoming.

The computers have extended their influence into all sectors of librarianship. The major applications in libraries are those with housekeeping routines such as acquisition, cataloguing, circulation etc., and those concerned with information retrieval. To get a picture of the present state of automation in our field I shall pinpoint some products and services which are found to be important and useful from the point of view of users.

Since the 1950's computers have been applied to the production of abstracting and indexing journals to ease the information problem and, especially, to provide faster access to primary information. All this has become especially important in those multidisciplinary fields of science which draw literature and data from many areas, where an individual scientist and library may no longer be able to keep up with the ever growing and often 'disorganised' literature.

Locally in libraries machines were used to produce abstracting and indexing bulletins and in-house lists of documents. In the 1960's the realm of KWIC-, KWOC-, KWAC- and other computer produced printed indexes was shaken by automated information retrieval. One of the most productive innovations at the time was selective dissemination of information (SDI) which reached a vast popularity among users of scientific and technical information. But even more convenient and more flexible systems were developed, and along with the development of telecommunication networks online searching facilities were introduced worldwide. The need for these types of services was great. Alina Vickery writes about the introduction of online services at the University of London: "The demand for them is real. Indeed, the demand for our pilot, experimental services surpassed all expectations. Computerised information services are not a private hobbyhorse. Rapid growth in their use is worldwide."

Since the 1950's, much progress has been made in the areas of housekeeping. As a result of computerisation, greater standardisation and cooperation library automation has passed through its experimental phase into the operational phase, and is taking its first steps in the direction of integration and networking. New information technology provides a wide range of novel services from on-demand publishing to teleconferencing. These novel services have already been tested for some time, and they will bring a welcomed addition to the present supply of library services.

Need for Information Systems

The links between those who create information systems and those who use them can be found when looking at the functions and objectives of library and information services. The main task of libraries is to collect and to organise literature, as well as to disseminate information from a storage medium to users. The common factor is therefore the information which is handled by information and library personnel and which is the most important resource for users — the raw material for their work.

The reasons for the development of information systems and services after the Second World War were rapid industrialisation and the growth of knowledge, together with the closer contacts between higher education and industry. Due to the expansion of documented knowledge, one cannot ever absorb all necessary knowledge. So there is a need for people who specialise in collecting and organising information. However, their task is also to help users to acquire and exploit all existing information.

This tremendous increase in scientific and technical literature in the 1950's and 1960's caused an information explosion. Therefore the problem of today is information overload. More revolutionary methods are needed to filter information to users in order to disseminate the right piece of information to the right person at the right time as the common slogan puts it. New revolutionary advances of computing and telecommunications networks are increasingly used to solve the technical problems of information storage and retrieval. Intensive research is being carried out in terminological control and rettrieval techniques, both trying to bring out better systems

for users. Interactive online retrieval has got the boundaries between indexing and searching closer but quite many problems are still to be solved. It is our responsibility to share this knowledge with professionals from other areas. Quite apart from that it would be a waste of special skills and knowledge no to utilise the vast literature of areas of information storage and retrieval.

The need for information systems can be verified when looking at their use. According to surveys conducted by the Finnish Council for Scientific and Technical Information and Research Libraries, for instance, online searching has grown nearly 50 percent annually in the 1970's (Myllys). Similar rapid growth can be seen worldwide where several million searches are carried out annually. It is increasingly difficult to forecast or even to count the present number of online searches performed. A major step towards online methods has been taken; online catalogues have taken the place of card catalogues and the number of online searches thus multiplied. This will be the final shift towards the automated handling of information and users are bound to face it whether they liked or not.

The rapid growth of interlibrary lending (ILL) services can be used as another indicator to verify the need for new information systems: library collections were not sufficient to satisfy the needs. At the Helsinki University of Technology Library SDI-services have been offered since 1969 and online searching to a greater extent from 1974. This massive retrieval of references has caused a steady growth of ILL services which has been 10 percent annually. With shrinking library budgets ILL is bound to flourish. Online ordering and telefax transfer have already been used to speed up old routines, and a great demand for novel services can be expected. Users will get the benefits: worldwide information will get faster and faster at their desks.

The libraries will certainly play a key role providing computer-based services as well as providing physical access to documents. However, despite all promising prospects the reality is that most potential users are still non-users and they may never become users at all. Several reasons can be listed: database inadequacy barrier, access barrier, apathy barrier and ignorance barrier as dicussed by Lea. In addition the slower growth of

library collections compared with that of information production makes the libraries probably unable to satisfy the various needs of the community.

Impact of Information Systems

Information systems have become very complicated during the years of automation. It is not self-evident how to use the system. Users must acquire the skills to master these new products and services. User education programmes are introduced by libraries to ease the adoption of new technology.

Computer printed indexes were the first automated products to appear. They were either liked or hated albeit used. In some fields of science they were adopted easily. That was the case in chemistry where Chemical Titles is a very important medium of current awareness. It had a strong impact on users. Of course it is a goal to publish papers in journals indexed by Chemical Titles but it also proved to have another interesting effect on terminology which became more and more standardised. Chemists became very conscious of choosing words into title headings: the proportion of relevant informative words in the title increased remarkably along with the automation.

Today users struggle with the diversity of systems. Interactive computer systems bring about the problems af man-machine communication. Hildreth divides the componets of the user system interface as follows: physical; organisational; personal; communicational; and functional. Each of them having an impact that should not be underestimated.

Physical Aspects

Components that form the physical environment encompass the users of new technology first. Accommodation and facilities are therefore of primary concern. With a lack of proper equipment the systems cannot be used. A well-planned workstation might inspire users to experiment novel methods. It is therefore obvious that ergonomic factors of workstations and

equipment are being studied to a large extent in order to know, for instance, how to direct the light or how to position visual display units. However, problems encountered with physical environment reflect the resistance of change that might be caused by other reasons.

Organisational Influence

Automation is a challenge for organisations in designing information systems and allocating funds and resources for services. A contribution made into new technology might pay it back many-fold. Brian Vickery made an interesting analysis of the factors that affect end-user access of online systems. He sums up "the contribution of factors is complex, and assessment of their relative importance is difficult. In my view, the major factors influencing a shift towards end-user access for bibliographic information are: (1) online use for all kinds of purposes is going to increase, and those in regular and frequent need of bibliographic information may well become searhers, (2) constraints on funding and staffing may force library and information services to encourage this trend."

Personal Factor

There are a variety of users with different information needs and habits as well as personal characteristics. Users might be different in terms of experience and expertise, too. The talk of elitism in connection with new information systems is not quite fictitious. My opinion is that there is a group of fortunate users who know how to act and utilise new media. However, sometimes too strong and false a reliance on new systems can be noticed. It is believed that everything can be obtained through automated systems. It is not an easy task to explain to users that it is not quite true. Another group is formed by those users who believe that there is not anything good and useful in a new medium but it should be feared and avoided. Quite apart from that there are differences which might be caused by personality, age, work and duties. Only motivating and well-designed training would be an answer to the questions raised above.

Communicating with Systems

Communication with systems has been so far one of the most popular problem areas. Varied dialogue modes and techniques have been developed and tested. However, user-friendly systems are still to come. Systems are not difficult to master but it is far too cumbersome to remember all system features and details like slashes, commas and abbreviations. Systems must be changed and not the users. I asked my student to compare three online systems she was familiar with. She came into conclusion that the factors which have a major impact in choosing the system are: login procedures; input of search terms; access points; displaying of indexes; combining terms and sets; display formats; and user guidance.

Cost Aspects

Libraries have traditionally offered their services free. No charges are made for loans from a library. Reference services are also offered free of charge. How can charging for new services be justified? On the other hand, new services based on expensive technology make it economically difficult for libraries to serve users due to limited and shrinking resources. This topic of cost aspects is being debated throughout the world.

As an example we can have a look at online searching. There are several factors that cause expenses: direct costs; staff costs; and initial starting costs like terminals, manuals, training etc. In 1980 in Finland direct costs for an online search from abroad were about 200 Finnish marks ($ 40) on an average. If, for instance, Helsinki University of Technology Library would offer one online search for staff and students annually free of charge it would cost nearly one half of the annual literature grant of 3.5 million Finnish marks ($ 0.7 million). It is entirely impossible to finance that. Luckily enough, our users are prepared to pay. Studies among our academic users showed that engineers are prepared to pay twice or even four times the direct costs, and departmental funds are used to pay for the searching costs for both staff and students (Haarala, Törnudd).

Some users have allocated money for the services discussed above. That would not always be the case with students and men from the streets. Where can they find money for getting information? In this context users of new technology will be in very different position. Alternative means of financing services have to be created to meet the need and requirements of different parties. Economic factors will have an enourmous effect on users' information gathering habits in the future.

Will the Libraries Have a Future?

It is not an easy task to vision the libraries of the future. Somewhere I read that if libraries have a future at all, they have better to prepare for it now. Surely libraries have a future role and surely they will use new information technology.

Library resources will continue to shrink. This should lead to integration and networking. However, technology will become cheaper and more powerful, and local information retrieval systems might be cost-effective and feasible.

There has been much discussion and many papers on the question as to weather end-users will carry out online searching and use new systems in the future, one of the most recent ones is a paper by Nielsen titled "Teacher or Intermediary: Alternative Professional Models in the Information Age". In the case of Helsinki University of Technology Library, users show that they will and they can use new information technology and new searching facilities. However instruction is necessary and its values have been proved: the Library has become very popular because of online catalogues, and online catalogues have increased the status of the Library.

There will be an increasing need for librarians who create systems and librarians who consult and teach users. Librarians themselves have to change in the course of social and technological change to meet the needs and requirements of users. Without such an approach to automation, we would not be able to meet our objectives because automation alone can solve the problem of information supply.

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ECONOMICS AND POLITICS OF INFORMATION TECHNOLOGY: Some Trends in its Application to Information for The Professional

by

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ECONOMICS AND POLITICS OF INFORMATION TECHNOLOGY:
Some Trends in its Application to Information for the Professional

INTRODUCTION

This paper is concerned with the application of new technology to what used to be called scientific and technical information, but now includes a wide range of other classes of information, summarised by some in the phrase "information for the professional". While of course a number of technologies contribute significantly to the total process of creation, reproduction, distribution, and retrieval of information, consideration in detail of all of these is not attempted. Instead, while keeping in mind that development in one part of the information production and distribution chain will very probably affect all the others, it is proposed to concentrate on the more visible features of the micro-electronics revolution which many consider to result in fundamental shifts in information economics and policy. For some, these interactions constitute a threat, for others a new opportunity, but in any event, the information community is rightly concerned to maximise the benefits resulting from these interactions and to minimise bad effects.

Micro-electronics and Information: A Historical Perspective

Information users and producers are currently faced with the possibility of a series of new innovations, whose impacts provide the main theme of this paper. However, it is proposed to place the discussion in a wider perspective of impacts of micro-electronic technology which have already ocurred, the better to assess the possible consequences of what may come in the second half of the present decade.

A convenient starting point might be the beginnings of on-line information retrieval in the late sixties. It may be noted that this development did not mainly arise as a result of pressures from within the information

community itself: it became a practical and economic method of retrieving information, partly as a result of developments in computer time-sharing, and partly as a consequence of the marriage of computer and telecommunications technologies to provide a networking facility which could be used simultaneously by a number of remote users. The National Library of Medicine and the scientific and technical information departments of NASA and the former AEC in the USA, and (to a lesser extent) what is now the European Space Agency in Europe, played an important role in pioneering on-line services. However, these initiatives were probably more in the nature of a technology push than a demand pull from the librarians and users. The degree to which this also applies to the application of new technologies in this sector of the information field today may be important in understanding the likely interactions between economics and technological innovation in the immediate future.

The growth of on-line, from what was felt by many to be an expensive piece of gadgetry whose performance in terms of recall and relevance was suspect, to a major international business, is a phenomenon which cannot be ignored. In the following section therefore, some of the economic and political aspects and consequences of the on-line revolution are briefly reviewed to provide a focus for subsequent discussion.

ECONOMICS AND POLITICS OF THE ON-LINE REVOLUTION

On-line Costs

The cost of on-line searching was a new overhead element in users' budgets, not a substitution. This undoubtedly caused some difficulty, especially in organisations which operated under rather rigid budget structures having no specific cost-centre under which such expenses could be charged, or those not perhaps fully appreciating the value of, and need for information. It was not surprising therefore that much of the early growth in on-line searching was from those industries having large

research and development programmes and well-founded information departments.

By the standards of users working in a traditional academic environment, costs were not insignificant. In addition to charges representing a user's share of the host computer centres' operating costs, long distance or international telephone charges were payable to the telecommunications Administrations or network operators. Further, by the mid-seventies, database producers were beginning to impose significant royalties per hour of interrogation and per reference printed. This development has been traced by Page [1] and Barwise [2] who also took into account the reaction of secondary publishers to what they believed would be a net loss of revenue as the sales of the printed product fell off as a result of increased on-line use of the parallel machine-readable version.

While these projections have not been checked in detail, the current level of royalties for most of the major bibliographic databases would indicate that this element of on-line user costs has risen substantially in the intervening years. Whether or not a causal relationship exists between on-line use and a loss in revenue from the printed abstract journals may still be an interesting subject for speculation, however, it is clear that behind it lies a more general economic problem, that of the rising cost of publication and restrictions on library budgets. The existence of of a new technology in the shape of on-line may have contributed indirectly by offering the possibility of substitution.

It is, however, often suggested that on-line has had a direct impact on library budgets, especially in institutions with rigid budgetary structures. Since on-line services are normally provided through an intermediary and these intermediary services are frequently provided by the library, the direct and indirect costs may often have to be borne on the library budget. If the budget is not increased, these extra costs must be met by

savings elsewhere: perhaps in new books or periodical subscriptions. It must be admitted, however, that this is an area in which there are many opinions but little systematic data.

On the policy side, the emergence of on-line as a major sector of the information industry has been accompanied by interesting developments. These may be conveniently grouped into a number of issues: commercial versus institutional/governmental services, large generalised systems or small specialised services, and internationalism and protection of home markets.

Commercial Versus Institutional or Governmental Services

In both the USA and Europe the first on-line services were offered by governmental organisations, and even before that the same organisations were responsible for building up the machine-readable databases used for batch information retrieval. To these databases were soon added others such as Chemical Abstracts, BIOSIS and INSPEC, etc., produced by scientific and technical institutions, the databases being a by-product of the production of printed abstract journals. Both governmental and institutional producers and service providers took what might be termed a public service view of their operations. On-line service providers such as NLM and NASA made no particular charge for the use of their databases, but offered them as a service to particular groups of users. A user qualified for access might be, in one case a group of libraries, in another research centres or main contractors. Another qualification for access was often the supply of input to the system. Similarly, the institutional producers made only a token charge for use of their machine-readable databases: the on-line community was indeed rather shocked when one such institutional producer, Metals Abstracts, decided in the early 1970s that on-line users would be required to pay the unprecedentedly high royalty of $20 per connect-hour.

At that time the repertoire of databases available to the on-line user was beginning to be enlarged by the addition of a new type of product developed not by scientific and technical institutions, but by commercial publishers, economic forecasting services, specialised industrial research and statistical services, etc., etc. While in some cases coverage included bibliographic information in research and development, most had a strong economic, commercial or marketing orientation and were aimed at a commercial or industrial clientele who could be expected to pay a commercial price for on-line access. By 1977 there were over 30 databases of this type out of a total of about 90 of all types available via the four main international services; by that time also, as has already been discussed, the general body of institutional database producers was beginning to increase royalty requirements up to a level not far short of some of those in the commercial category. More recently, some of the governmental (and intergovernmental organisation) producers have begun to move away from their former policy of unlimited free access fees, while others have introduced a quantitative relationship between database use and the provision of input.

Looking at the policy adopted by host operators, this has also followed the same trend. During the early days of on-line, the governmental and intergovernmental organisations offering on-line services in the USA and Europe did not attempt to recover costs for their computer operations from users. However, in the USA, the on-line market became dominated by commercial or not-for-profit operations at an early stage, while in Europe what is now ESA/IRS was required to adopt a policy for charging which would ultimately lead to full cost recovery.

To sum up, the introduction and growth of on-line services, as a recent and important example of information technology, has undoubtedly contributed towards a move away from the former concept that information is somehow

different from other commodities in that the user should not have to pay for it directly. Much of information policy nowadays accepts the alternative proposition that information is a commodity like any other to be bought and sold in the market place. It seems clear that this approach is not confined to paying for the added value of the ordering process by which the computer and retrieval system selects only relevant information from the total mass, but also for the right to possess the information itself (in the form of a computer print-out). Moreover, the user is required to pay to look at it to judge its relevance, a relatively new commercial principal not so far applied in other sections of the information industry, for example, bookshops and bookstalls.

Without making a value judgement involving the role of on-line in increasing the commercialisation of information, it is noteworthy that some authorities regard unfettered operations of an information market place as essential: Summit [3] writing in 1978, regarded possible competition from government agencies in the supply of information goods and services as "perhaps the single most significant problem we will face over the next twenty years." He advanced the argument that if government agencies were allowed to provide such services at lower costs than commercial organisations, the real price that the community would be paying would be government control of information. While some argue that if that danger ever existed it has now receded, as (particularly in the USA) the market is almost totally dominated by commercial services. Nevertheless, the fear of government control of information is still a frequently-recurring theme of information politics in the Western industrialised countries, especially in terms of the misapplication of privacy legislation.

Large General Systems or Small Specialised Services

The growth of on-line has been accompanied by active competition among the major service suppliers for a share in what they considered to be an expanding market whose saturation point could not be foreseen. Such competition was perhaps the natural way of achieving a high growth rate; it stemmed directly from the strongly commercial orientation and free enterprise environment of the American services first in the field.

These factors actively encouraged the growth of the information supermarket, as distinct from smaller, local or specialised operations. Marketing factors, such as the need to reach as wide a clientele as possible, dictated that a service should cover many subject fields, resulting in the acquisition of many databases covering a wide-ranging selection of subjects. There were good operational and economic considerations for an on-line service to try to move in this direction. First, since many users and potential users were intermediaries, perhaps being library or information centre personnel having to serve an end-user population of many different interests, the attractive feature of an information supermarket was the high probability that all questions could be answered without switching to a different host, requiring a different search procedure. Second, there were economies of scale to be gained, not so much in the cost of hardware (a reducing component of total cost in any case), but also in personnel costs spread over the greatly increased number of items of services which the supermarket approach made possible.

The critics of the supermarket approach offered much the same arguments against them as did the advocats of the corner grocery store compared to the supermarket food chains: loss of the personal touch, lack of knowledge about the product (no subject expertise), etc. But was information system know-how more a requirement than subject expertise in running an on-line service? However, providing the computer centre overhead could

be kept low enough, certain small specialised services, including those serving a discrete clientele with very specific needs, were able to thrive during the battle between the information supermarkets, particularly if they could offer some extra added value, such as computational facilities linked to data or information retrieval.

An example of a different approach was that taken by the Federal Republic of Germany in its Technical Information System concept developed during the seventies. This was an overall concept for the provision of scientific and technical information services within the Federal Republic, and involved a vertical integration of services within a given subject field, rather than a functional separation between database production, on-line services, library services, information supply and information evaluation, etc. All such services were to be included under a special organisation for each main subject area, a Fachinformationszentrum (FIZ). At one stage no less than 17 such separate FIZ's were proposed, but so far only a few have been implemented; it appears that at least in so far as on-line services are concerned, the balance seems to be in favour of a rather greater amount of concentration than was provided for in this concept.

Internationalism Versus Protection of Home Markets

The much more rapid growth of on-line in the early seventies in the USA as compared with Europe (both areas having potential user populations comparable in size and requirements), was partly due to the existence of good data networking facilities in the USA as compared with Europe. Other factors were probably the existence of entrepreneural organisations in the information field, and also the inhibiting effects of national boundaries on the growth of transnational activities like regional data networks and regional information services. Initiatives such as that of what is now ESA/IRS were not able to grow as rapidly as their US counterparts because of these factors. This left a gap which was soon filled by the American

services which were able to export their products through nodes of the Tymnet network (now referred to as Tymshare nodes), established at various locations in Europe. Although the legality of using the public switched telephone networks to access US hosts via what amounted to a foreign private network was questionable, the European telecommuncations Administrations by and large turned a blind eye to this for some years, presumably on the grounds that the Tymshare nodes provided a service they were as yet unable to supply. The result was that US services gained a position of dominance from the early seventies onwards which has only recently begun to be eroded, in spite of massive local investment undertaken since the inception of EURONET.

Although the Council of Ministers of the EEC had passed a resolution in 1971 calling for the establishment of a European scientific and technical information network and services, this was slow to bear fruit. One possibility was for the Commission to cooperate with ESA in further development of ESANET, perhaps converting it into a packet switching network on the experience gained by international computer networking experiments in Europe. Thus, one or two other hosts could have been added for a planned coverage adequate to provide strong competition for the entrenched US services, undiluted by internal competition among individual European hosts. This, while probably providing the most speedy solution, was not the one chosen by the Commission of the EEC for a number of reasons. Instead, it was decided to negotiate an agreement with the European telecommunications Administrations to develop a semi-public data network, largely financed by the EEC but to be developed and operated under PTT management. Negotiation and network development took some time, and it was not until late 1979/1980 that EURONET became truly operational.

National policy makers in the information field in Europe saw the development of EURONET more as a background against which national policies

could be instituted, rather than as an opportunity for developing a community-wide linked series of (few) on-line services each big enough to compete with American services in specific fields. While for a brief period the Commission attempted to introduce a policy to control the admission of hosts to the network to prevent duplication, this was soon abandoned in the face of heavy opposition from the Member states. The development of EURONET was accompanied by much activity on the national level to provide host services, either supported by public funds or as off-shoots of the information industry. The result was, at least in the early years of EURONET, a multiplication of proposed or actual host services with the popular databases being over-represented at a level which tended to inhibit economic operation of them by any host. Some of the larger countries seem to be adopting a policy of national self-sufficiency at all costs, while smaller countries were concerned that these tactics would result in the degradation of existing European international services on which they relied. To some extent, the situation has begun to rationalise itself, with host services tending to specialise in particular markets rather than compete amongst themselves. However, we are still far from a fully articulated national and international-European policy in this area.

Meanwhile, the telecommunications Administrations realizing that European use of US host services was a potential revenue-earner for them, adopted a policy of legalizing the Tymnet/Telenet operations by taking them over, purchasing the necessary nodal equipment and software, billing European users for use of the telecommunications circuits as a whole, and passing back a proportion of these charges to the US network operators for their share of the circuits. While to some, European policy in respect of EURONET and EURONET DIANE (the network of host services superimposed on the physical network) is seen to be a protectionist reaction against the successful US penetration of the domestic European market, the contrary

interpretation is also possible, if one views the actions of the European PTTs in removing legal (and possibly economic) impediments to the flow of database interrogation traffic from Europe to the USA.

DOCUMENT DELIVERY—THE NEXT MAJOR TECHNOLOGICAL CHALLENGE?

Background

Summit [3] suggested that document delivery would be one of the major areas of activity in the professional information field during the 1980s and 1990s: he stressed the imbalance between progress in information retrieval and a virtual standstill in document delivery techniques. This view is also shared by a number of authorities in Europe, particularly the Commission of the European Communities. Following the extensive surveys of document delivery in Europe carried out in 1978 and published as what became known as the Franklin Report in 1979 [4] the Commission funded a major study by Arthur D. Little on electronic document delivery resulting in the ARTEMIS Report published in 1981 [5] . These findings were extensively discussed at a Workshop held in December 1980 (published as Electronic Document Delivery II [6]). A number of issues were raised in that discussion, including particularly questions of user acceptance, costs, and effect on organisations concerned with conventional information supply, such as publishers and libraries.

As a result, the Commission funded a programme of studies on a number of important technical aspects of electronic document delivery and electronic publishing, and to test user acceptance and the economics of possible future operational systems, a programme of operational experiments was also agreed under which Commission funding (perhaps an average of 25% of the total cost of selected experiments) would also be provided. Actual experiments will be carried out as from January 1984 and will extend over 18 months or possibly two years. Successful experiments should lead to self-supporting systems requiring no subsidy from the Commission after the

conclusion of the experimental period. The programme is fully described by Vernimb, Page and van Slype [7].

While avoiding the temptation to make detailed predictions about the shape of possible services based on the work over the last two years and the likely experimental scenarios (not to mention developments in the USA and elsewhere), it seems possible to indicate some of the impacts which might result, should electronic document delivery systems take off in the not too distant future. It will be useful to use the brief historical summary of the impacts of on-line dealt with in the earlier sections of this paper to suggest certain trends which we may also observe in the document delivery case.

Economic Factors and Technology Options

Costs, technology options and user requirements in electronic document delivery are related in a complex fashion. In the following paragraphs it is proposed to summarize some of the important interactions which will affect the user's view of the cost-effectiveness of what is offered.

Coded Characters or Facsimile Images. If a page of text can be represented in simple ASCII coding, an average A4 page containing 4,000 characters will require 4 kilo byts of data. If on the other hand we scan the same page in Group 3 facsimile we shall require about 500 kilo bytes of uncompressed digital data to represent the page, or perhaps 50 kilo bytes of data if a compression algorithm is applied. There is thus a factor of at least 10 between the data volumes required for the two methods of digitization, and this fact is fundamental to all the costs involved. An existing text may be scanned by OCR techniques but anything possessing simple or complex graphics requires facsimile scanning. Moreover, we may need even higher resolution than Group 3 facsimile to adequately deal with some texts, for example, complicated mathematics. While costs of digitalization and storage (where applicable) will not in the long run be a major

drawback to a facsimile-based system, this is most certainly not true for telecommunications charges for delivery in facsimile mode using data networks with volume-dependent tariffs.

There is thus a strong pressure for using coded characters wherever possible with some form of hybrid system to deal with tables and graphics, etc. As an alternative, it would be pleasant to think that one might be able to negotiate special tariffs in which the large-volume bit streams required in high-resolution facsimile did not involve such high penalties as they do under present tariffs for interactive traffic on packet switching networks. This alternative is perhaps unrealistic, at least until the PTTs in Europe have managed to develop the so-called Integrated Services Digital Network (ISDN), in which broad band data circuits will, it is said, be available at rates comparable to the cost of a telephone call.

Electronic Text as a By-product of Computer Typesetting. The cost arguments in favour of coded character methods of digitization suggest that we should take advantage of the fact that many texts are now set by computer to use the resulting digital bit stream as the basis for the electronically-delivered version of the text. On examination, the possibility is not so attractive: among other difficulties, each manufacturer has his own system so that there are no standard forms of output which could be used for document delivery. The problem has been examined by PIRA in a study known as COMPCOMP [8], with the recommendation that a solution was possible by developing a "virtual typesetter", the output of which would be a coded character bit stream in a standard document delivery format, yet to be defined. In passing, it may be noted that even for simple texts such as may be produced by any office word processing equipment, compatibility problems between the output of different manufacturers' machines continue to exist.

The Technical Requirements for User Terminals. PIRA in another study known as EXCHAR [9] showed that a very large number of characters were necessary to represent scientific text in coded form, particularly in the areas of mathematics and chemistry. They showed that solutions were possible based on new international standard procedures, developed primarily for extension of the Teletex system. However, the complications arising from the need to convert computer composition output and the possible need to provide both for the reception of facsimile images and coded characters on the user's end of the delivery chain, makes the design of the user terminal for document delivery rather complex if it is to be capable of receiving all types of scientific documents. The possibilities were examined by Logica in a study named DOCTERM [10]. They suggested that terminals fulfilling all the requirements for document delivery would be available within the period 1983 to 1985, at a cost of between 10,000 and 15,000 European Currency Units (ECUs). To receive document copies on simple terminals, it would be necessary to develop some kind of black box which could at least indicate to the user terminal that designated parts of a text were undeliverable to that terminal.

Technology Options—Impacts for the User. Electronic documents generated on office word processors could readily be delivered to users electronically without great expense or difficulty, but there are compatibility problems, which in the end may be solved by the universal adoption of the teletex standard. More complicated scientific texts and graphics are a different matter and while the capture and delivery of these will be tested in the CEC programme of experiments, costs may restrict the electronic delivery of high quality copies of such texts to large volume users such as major libraries and industrial organisations able to spread the costs of the necessary terminal equipment. Small users would either have to be content with a degraded or incomplete copy of "difficult" texts

or use the services of a local document supply centre or information broker acting as an intermediary.

In some ways, this could be regarded as parallel with the situation at the beginning of the on-line revolution; terminals were at that time beyond the reach of end users; intermediary services were necessary because of the complexity of database-retrieval systems, etc., etc. Can we expect a similar reduction in costs as helped popularize the on-line search in the case of electronic document delivery? There are some indications that in some areas of costs, similar possibilities might occur during the next few years: the reducing cost, increasing sophistication and improved user friendliness of such devices as intelligent laser printers may be pointers. If one chooses to be optimistic, a breakthrough would occur if high resolution facsimile became a normal piece of office equipment and ISDN or similar services, perhaps direct satellite transmission, really resulted in reduction of facsimile transmission costs to a few cents a page. It seems highly improbable, however, that spectacular developments on the equipment side, or a breakthrough in telecommunications costs will occur as a result of demand pull from users of electronic document delivery services. As in the early history of on-line, the pull must come from outside the professional information community.

The Office Automation Industry. Most of the requirements in electronic creation, capture, storage and delivery of simple and complex texts, graphics, etc., are almost exactly paralleled by requirements in the all-electronic office. The terminal developments noted by Logica in DOCTERM [10] as likely to fulfill the document delivery requirements are being undertaken for programmes of this kind. If a user's equipment for document delivery is in practice part of an integrated electronic system for management and administration in his organisation, its marginal cost as a document terminal could readily be absorbed. There are problems,

however, mainly due to the difficulty of standardisation. Current computer communication systems, even the most sophisticated of packet switching networks, employ only the first three levels of the ISO's seven layer Open Systems Architechture. The interconnection of different local area network systems on which run office automation equipment requires standardisation of the upper layers of the ISO reference model which has not yet been achieved. In the meantime, the major suppliers in the automated office industry have produced, at great expense, their own networking and protocol systems, which are inevitably incompatible with each other.

Impacts On Scientific and Technical Publishing. The close relationship between electronic document delivery and electronic publishing is evident: a possible new market for electronic texts, electronically or otherwise delivered, may provide a motivation for scientific and technical publishers to adopt electronic publishing techniques, and those who are already in the computer-assisted editing and composition business may be tempted to enter the market for document copies produced as a by-product, whether these are delivered electronically or otherwise. One major publisher has gone on record in saying that the main reason for primary publishers to go into electronic publishing and document delivery is that it gives them the opportunity of regaining control over the distribution of their material (and therefore obtaining revenue from it), which they had lost due to photocopying and the inter-library loan systems. There seems to be no doubt that should publishers enter the electronic document delivery field on the scale envisaged, for example, by the original partners in the ADONIS consortium, they could increase their revenue by the direct imposition of copyright charges payable by the user as part of the fee for the service. Should such operations be carried out on an international scale, this would cut across different national copyright legislation and practices: since the copyright charge would be levied by the copyright

owner or his licensee, the transaction would be outside the various national legal provisions which concern copying by third parties. The interesting situation could arise in which "fair copying" practices were allowed in inter-library lending situations, and electronic copy and photocopy service could be in direct competition.

Small Versus Large Publishing Enterprises. To enter the electronic market, a publisher must be prepared to invest considerable resources: for example, in electronic text processing and computer composition systems, if these do not already exist, and in image-processing equipment if he wishes to offer a service in material already published. He will need to develop an archive on a full-text host (a mainframe computer) or license someone else to do this. Software will be required for archive management, updating and automatic location of items to be delivered following an order, which may arise from an automatic ordering system.

All this seems to favour the big publishers rather than small enterprises, who will scarcely be able to afford the level of investment: small publishers may have to join together to form cooperatives if they are to remain competitive. This, however, could only improve the logistics of maintaining an electronic infrastructure: it may do little or nothing for the small publishers who publish journals with a relatively limited circulation. Statistics of inter-library lending/photocopying show that the majority of the demand for photocopies is for copies of recently published articles in the more popular scientific, technical and medical journals; the electronic dimension therefore seems to favour the big publishers on both counts of investment and demand. Once again, this is a trend which we have observed in host services in on-line information retrieval.

Should the large publishers be able to better exploit the opportunities offered by electronics than their smaller colleagues, there must be

some cause for concern on how publishers in minority languages can keep abreast of their international "big brothers", who based on their existing large home and export markets for printed versions could presumably find it relatively easy to maintain their position of dominance in electronic versions. A single culture dominance and centralisation in the more popular information media are already factors of concern to many politicians outside the native English-language region, and a possible reinforcement of these trends as a result of electronic full-text applications in a more specialised field might also be viewed with some concern.

Transborder Data Flow. The transfer of electronic full texts could therefore add to the transborder data flow problem. At present, many countries are concerned with the uncontrolled flow of data in and out of their territories via telecommunications networks, whether their main concern is for national security, trade advantages, protection of home data-processing industries, maintenance of tax revenue from national data transactions as distinct from untaxed exported data processing, or simply the rights of the individual enshrined in national privacy legislation, which might be circumvented by unscrupulous persons exporting such material to "data havens". It is perhaps difficult to see how international data flow in full-text documents for the professional could seriously endanger personal privacy or other basic rights, but such claims have already been made in the case of other electronic materials. Perhaps the transborder data flow issue in the case of electronic full texts should therefore be looked at from the opposite point of view: supposing for example, the regular import of such texts from a "data haven" which did not observe the international copyright convention, and moreover which allowed the recipient to avoid paying VAT on alternative nonelectronic national services, resulted in a refusal to accept any such data trans-

actions by the national PTT regardless of origin. Would this not constitute an unacceptable element of government control or censorship?

IMPACT ON LIBRARIES

Libraries are the traditional focus for professional information-seeking and for document supply. In spite of many misgivings by traditionally-minded librarians at the beginning of the on-line era, almost all libraries catering for the professional quickly adjusted to the new technology and now are the recongized focus of intermediary services for their users. It would seem that electronic document delivery, whether as an adjunct to or substitute for inter-library lending could also constitute a natural development of information supply services to library users. As has already been noted, cost problems are likely to be a difficult obstacle, particularly in the early years of development of such services; but for the reasons already stated there are prospects that these can be surmounted, particularly if demand can be encouraged and costs spread over a number of office automation applications. An innovation-minded librarian will certainly be able to play an invaluable role helping a user to select appropriate sources of supply for electronic documents, as indeed he does in conventional document supply.

There are other possibilities for economic electronic services which a library might be ideally equipped to supply. Acquisition and management of space for traditional archives is a costly business, but one which is far more a question of librarianship skills than those associated with other elements in the information supply chain. The very high volume of material which can be stored and quickly retrieved on such media as the Digital Optical Disc, and the possibilities of minicomputer access and control of such systems, makes it possible to consider individual libraries acting as electronic archives for infrequently wanted material, perhaps highly specialised collections or back numbers—which could be housed

and maintained at relatively little cost, and could provide the source for backup services to all parts of the information supply chain.

ELECTRONIC TEXTS AND THE INFORMATION EXCHANGE PROCESS

The fact that texts can be created, manipulated remotely, electronically stored and transmitted instantaneously to remote locations is potentially a source for fundamental changes in our pattern of information exchange. Up to now electronics have been the means of easing the problems of ordering and selecting relevant items of information (the information itself being the printed word) resulting from traditional methods of origination, refereeing, editing, publishing, printing and distribution. We tend to think of electronic document delivery and electronic publishing in terms of adding electronics to other links in the time-honoured chain of information transfer: we substitute an electronic journal for a paper journal, a full-text electronic store for shelves holding a collection of journals or reports in a publisher's store or in a library; and the electronic copy which reaches the user's desk is a substitute for a photocopy of the report or journal containing the information he wants. Of the four scenarios the CEC considered as likely to include all of the proposals for experiments,only one did not involve an analogue (paper or microfiche) document form as either the basic input material or the principle output: the extensively-researched plan of the ADONIS group looked in essence at electronically scanned versions of existing printed journal articles and storage on a sophisticated electronic medium from which paper copies were reconstituted and sent by mail, i.e., an electronic replacement of storage racks and the photocopier at the document supply centre.

If we look at the process of electronic creation, storage and distribution of professional information as an independent system for information exchange, other possibilities begin to emerge. Three examples are

given below in scenario form.

An Electronic Invisible College

A number of research institutes decide to collaborate in, say, the social and economic effects of new information technology. They exchange research plans, assessments of previous work, outlines of proposed joint research reports, drafts for comments and sections of collaborative papers, all input to distributed databases via word processors—the institutes being connected via a computer network. A mail box system provides messaging facilities and a simple computer teleconferencing service replaces many of the physical meetings which would otherwise be necessary. Finally, since this is the real world and people still have to advance their careers by building up a list of publications, a book or books is jointly written, edited and refereed, but almost all the real work of information exchange has been done before the book emerges. Members of other electronic invisible colleges working in adjacent fields may also have been given access to the database or parts of it on a quid-pro-quo basis.

Should invisible colleges be successful as a means for rapid real-time information exchange, rather than exchange of records of historical events (as is offered by most formal publications reporting research and development results), we might begin to see a rationalisation of the process of the information dissemination in science and technology as a whole. Less formal publication and more effort on up-to-the-minute information exchange would surely not be a bad ideal to aim at. Electronic invisible colleges (for which considered and detailed proposals have already been made), might provide the basis for such a reform.

Conventional Distribution of Electronic Texts for Local Sorting and Retrieval

Difficulties caused by the high costs of the telecommunications facilities needed to transfer electronic copies of wanted documents from

documents stored in electronic archives to the user's desk have already been stressed: it is clear that much technological ingenuity, not to mention money, will have to be expended to find ways of avoiding the use of the simplest and most direct means of digitization (high resolution facsimile) because of the high telecommunications costs incurred. Some authorities, notably K. Haefner [11] has suggested that modern technology provides a means for decentralizing information systems. A brief summary of a possible decentralized system using digital optical discs occurs in reference [6].

The principle is that an information centre specialising in a particular field (Fachinformationszentrum) maintains bibliographic databases and relevent full-texts on digital optical storage, repackaging information, necessary for individual organisations, institutes and possibly isolated users. Copies of appropriate full-text information are sent by physical means to user organizations, who have the choice of various combinations of retrieval and access systems to the primary literature, depending on their needs and local computer facilities. The latter could range from a personal computer to a large mainframe. Such a system would be highly flexible, the user having a large number of service options to choose from, and virtually independent from telecommunications. Even in the most sophisticated case, only local in-house telecommunications would be necessary (local area networks) to connect devices; at the other extreme, the individual scientist subscribing to the system would be able to assemble his own full-text database, possibly on video discs with a simple retrieval system suited to his own personal computer.

New Information Systems Tailored to the Needs of Developing Countries

Researchers in developing countries may have access to the on-line systems of the industrialised countries but at a considerable price in telecommunications charges. Conventional document delivery systems are also

available, but delays are considerable and there is often a hard currency problem. There has therefore been some pressure to organize regional information systems to give these countries a degree of independence in this respect. However, the infrastructure costs of setting up a bibliographic host system on conventional lines (sometimes known as the mini-Lockheed scenario) would be very high, and in many areas local and regional telecommunications facilities would not be adequate. Moreover, it has often been stated that (with the exception of a few research and development scientists), the needs of developing countries for information are not met by the contents of database collections developed to meet industrialised-country needs. This point has been discussed by a number of authors, particularly Woodward [12], who pointed out that full exploitation of local information, and particularly the development of databases tailored to actual needs, are significant factors in development.

An actual example is provided by the Nonaligned Movement which requested UNECSO and UNDP assistance in studying the problems of designing and operating an information system to give access to several categories of information, including documentation of the Movement itself, its records and specific information on development problems: it may be noted that the Movement comprises a large number of countries spread out over all parts of the world. A solution rejecting complex telecommunications links in the first instance was proposed, on the basis that a centralised database production activity for full texts could be satisfactorily organised comparatively cheaply on a minicomputer basis, with electronic copies of the whole or special selections from it according to need, distributed by mail or air courier to users in all the member countries. This would be combined with an information brokerage activity for selecting information relevant to specific problems from conventional databases and data banks held on host computers in the industrialised countries. Only later, if

and when suitable narrow and broadband data communications became available at reasonable rates (perhaps by regional satellites), would it become sensible to link users and the central facility by telecommunications. The project, known as IDNAC is fully described in a UNESCO Report [13].

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NEWWAVE : the on-line cataloguing system of the Royal Library in Brussels

by

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1. Historical background

The automation of the Royal Library started at the beginning of the seventies. The first system was a pure batch system with punched cards as the input medium. After a few years the batch system was replaced by an on-line data input and correction program, where the records were keyed in at a terminal and could be retrieved by their identification number only. The librarians disposed also of an on-line authority file of Belgian publishers.

The development of NEWWAVE was started at the end of the seventies. It is an interactive real time cataloguing system with extended retrieval facilities. The system is installed on a Siemens 7531 compact computer which runs with the BS2000 operating system. Thirty terminals, placed in different sections of the Royal Library and in the library of the National Archives are connected. All the programs are home made and written in Assember language.

2. Basic objective

The basic objective is to provide a group of libraries or library sections with an interactive real time system, in order to automate the different library functions (cataloguing, acquisitions, loan, etc.). The final aim is an integrated system with networking facilities.

Networking requires, in some way or other, standardization. This is achieved in two ways : on the one side by applying uniform cataloguing rules and internationally accepted subject indexing systems and on the other side by storing records in a (UNI)MARC compatible format. The uniform cataloguing rules take into account the international library environment as well as the Belgian bilingual situation. For subject indexing the UDC (Universal Decimal Classification) and the LCSH (Library of Congress Subjects Headings) are chosen.

3. Logical file design

3.1 General principles

The bibliographic data are stored in two main files : the authority file and the ISBD file. For both files, the information consists

of two parts : fixed length data and variable length information, each of them stored in appropriate fields. The contents designation is based on the MARC II tagging scheme. Subfield codes appear internally in the database. They are created on the basis of the punctuation in the variable fields, but are not displayed on the screen.

NEWWAVE provides the facility of linking ISBD records to records of the authority file. It is also possible to link records of the same file. The link is realized while entering the identification number of the related record. Most links are mutual, which means that indicating a link from record A to record B, whether they figure in the same file or not, automatically produces a link from record B to record A.

3.2 Authority data file

In the authority data file we store bibliographic information of different types : personal authors, corporate authors, publishers, subjects and uniform titles. The type of authority record is indicated in the fixed field of the record. In case the author, personal or corporate, is a publisher as well, a second indication is added in the fixed field. This allows to store the author and the publisher in one and the same record.

The main heading of the personal name record is stored in tag 100. We also store variant name forms for which in an off-line catalogue a supplementary entry is created, either as a complete bibliographic description or as a see-reference. We distinguish variant name forms entered in full text by the librarian (tag 101) and permutations of composed name forms created by the computer program (tag 102). The permutation algorithm is based on blanks, punctuation and prefixes. In case the author is a publisher too, the place is entered in tag 800 and the imprint is automatically created (tag 105). A personal name authority record is either created by a librarian or by the computer. The latter case is performed when the full author name is added to the ISBD. A matching algorithm searches for the personal name in the authority file and if no correspondence is found, a new authority record is created.

For the corporate author record the main heading is written in tag 110, variant forms in tags 111 and permuted forms in tags 112.

Here, the permutation algorithm is based on punctuation solely, i.e. on the point and the acute bracket. The imprint is stored in tag 115. In the case the corporate body has two equivalent names in Dutch and French, two main headings are created and a language indicator is added. The other tags of the authority record also have a language indicator in that case. Tag 805 contains the publisher's registration number in the Legal Depository section of the Royal Library. This number being present in a lot of Belgian books, an easy linking facility is possible, when creating the ISBD. Corporate author records can be mutually linked for reproducing see-also references (tags 712 and 713); this is necessary when a change in the name has to be registrated.

The subject authority file is based on the Library of Congress Subject Headings and these are translated into Dutch and French. Each subject heading is stored in a separate record containing all the information on the concerned subject concept, including the see-reference forms and the links to related terms (see-also references). The main heading is entered as tag 650 with an appropriate language indicator. This means that there will be in general three tags within one record, i.e. an English, a Dutch and a French form. The tags 651 contain the non-retained forms and the tags 652 give permuted forms. Referring to related, narrower or broader terms entames mutual linking procedures (tags 701 to 705).

The uniform title authority records contain the uniform title in tag 230 and see-also references to other versions in tag 710. This authority file is not intensively used for the moment.

3.3 The ISBD file

It is not our intention to describe each tag separately. We will only draw the attention to some special points.

The ISBN is written in tag 020. A wrong ISBN is refused in tag 020 and can be entered in tag 021. In this tag no control is performed. In the batch catalog a wrong ISBN will be preceeded by an asterisk. The same procedure holds for the ISSN, with the appropriate tags of course.

The author is written in tag 100 and the name is preceeded by the intellectual responsibility indicator. No indicator means that the

author acts as primary author. The personal author can be entered either by the identification number of the authority record or in full text. In both cases only the identification number is stored in the ISBD record.

The corporate author is written in tag 110, and is also preceeded by an intellectual responsibility indicator. The corporate author has to be typed in by its identification number as no matching algorithm is foreseen.

The title is written in full text in tag 245. Three different input techniques are foreseen for entering the author statement, namely the completely automatic creation, the semi-automatic creation and full text input. Using the information already present in the bibliographic description, more particularly the author name from the authority file, the intellectual responsibility indicator of the author field and the language of publication mentioned in the fixed field, the author statement can be created completely automatically. A semi-automatic creation technique is used when the text between the names of the authors cannot be automatically reproduced. In this case the full text between the names is entered and the identification of each author name to be added is indicated by a double dagger code followed by the tag of the concerned author. If none of these two techniques can be applied, or if the librarian does not want to take advantage of them, the author statement is keyed in completely. Note that in all cases, once the author statement created, the information is kept under full text form in the ISBD record.

The edition statement is entered under filing form, eventually followed by the deviating form on the publication (tag 250).

For the imprint the publisher's place and name are stored in one variable field and the date in another one. The date information needs no special attention. Concerning the first variable field, called here the imprint form, two methods of entering the information in the ISBD are foreseen. The first technique is a linking mechanism similar to that of the author. The imprint form can be processed through the introduction of the record identification number of the corresponding authority record or through the publisher's inscription number in the Legal Depository and has to correspond with the language of the book

title. The correct language form(s) are taken from the authority file while using language indicators. There are four different combinations of language indicators : 'n' for the Dutch form, 'f' for the French form, 'nf' displays first the Dutch form followed by the French one and vice versa if 'fn' is typed. There are two good reasons for using authority data for the imprint. Normally, the imprint form of a certain publisher is the same for all his publications. Thus the use of authority file data avoids the systematical repetition of identical information. A second reason is that in off-line applications indexes of publishers are needed. For this purpose batch programs similar to those processing the authors can be used. Using this technique the imprint form is stored in tag 270.

The imprint can also be entered in full text in the ISBD record. This working method is used if the imprint on the publication differs from the normalised form in the authority file or if the librarian prefers this way of working (tag 260).

The series title is entered in tag 445 by a linking method or in full text in tag 444. The former method is used if the books in the series are regularly acquired. The linking method for series is discussed in 3.4 .

The collation (tag 290) and the notes (tag 5xx) are introduced in full text.

Apart from the subject authority file, there are several other indexing systems.

UDC-numbers are used by the library of the National Archives.

For the production of a bibliography of scientific articles in Belgian periodicals, two thesauri are used : the Thesaurus of Engineering and Scientific Terms (TEST) and the Medical Subject Headings (MESH).

A set of 500 subject words is used by the Belgian Bibliography section. The system being very simple in its concept is useful for producing the monthly publication of the Belgian Bibliography. In the online catalogue however, we are experiencing the inconveniences of the limited subject list. These subjects are entered in full text in the ISBD record and are no part of the subject authority file.

On the contrary, the Library of Congress Subject Headings, stored

in the authority file are linked with the ISBD record block by their identification number. Upon display the English, Dutch and French forms are separated by an equal sign.

3.4 Hierarchical links between ISBD records

There are five different kinds of hierarchical links between bibliographic descriptions, namely

- series
- complex monographs
- supplements
- accompaying material and
- analyticals.

In order to establish hierarchical links two different kinds of techniques are possible : a so called series linking technique and a technique of complex monographs. Each bibliographic entity gets its own ISBD record, the result of the linking being a tree structure. For both techniques the links are mutual. Only the link from the lower level to the higher level has to be introduced and the reverse link is generated automatically.

The difference between both techniques consists in the way the reversed links on the higher level are presented on the screen. In case of series linking the higher level record contains only one tag, indicating the number of linked records. The complete list of linked records is displayed as a result of an explicit demand. On the contrary, for complex monographs each record of one of the higher levels contains a complete list of all the lower level records. In order to clearly present the full tree structure this list is sorted each time a new item is added or an old one is deleted. Each lower level title is presented in a separate tag field. Links for supplements and accompanying material are established by one of both techniques, according to the librarian's choice. The same holds for analyticals : in order to describe articles in periodicals, the series linking technique will be used whereas for the analytical description of an omnibus the complex monographs method is preferred.

4. Functional description of the system

4.1 Protection

On-line terminals are installed in different sections of the Royal Library and in the library of the National Archives. Each terminal connects itself to the system while giving the name of its section, in abbreviated form. This name is used as a password for the protection of data and as an identifier of the cataloguing source. The data protection level defines the functions the terminal may exercise. All the terminals are allowed to retrieve information in the whole database but data entry and correction are prohibited for some terminals. The highest level of protection is used for authority records.

4.2 Data input, data correction and data elimination

The input is done on a preformatted screen of 23x80 characters. In the first line two characters are foreseen for the query command. In general the first one defines the action (for example : 'A' for retrieval, 'N' for data entry, 'K' for correction) and the second one the file to be accessed ('A' for the authority data file and 'T' for the ISBD file). The fixed field data have to be typed in predetermined places. The variable fields get nearly free input possibilities. They are typed starting from the second column of the screen. Each variable field starts with a dollar sign, followed by the tag number and the repetition character, ranging from A to Z. The following two bytes are reserved for indicators, so the text input starts at column 9. A tag has to be completed on the screen on which it is started. Up to three screens can be filled with data. The end of a description is indicated by three dollar signs.

Every information can be corrected. All the corrections are processed on tag level and not on record level. The type of correction is indicated in the first column of the screen : 'k' means a correction of a tag, 'n' means adding a new tag and 'e' means the elimination of a tag. Corrections in the fixed field are performed without any indication.

Every record can be eliminated provided that no links exist with other records. In case that a record with links needs to be eliminated all the linked records have to be eliminated first.

4.3 On-line indexes

The creation of a new record, its correction or elimination causes a real time update of the on-line indexes. The terms in the indexes have a length of ten bytes and are extracted from the following variable fields : personal author, corporate author, title(s), publisher, subject, Library of Congress Subject Headings. Words longer than ten bytes are truncated and words shorter than ten bytes are filled with blanks. In case of a personal name the first nine characters of the surname are taken, followed by the first character of the Christian name. Each term in the on-line index is preceeded by a single character representing the tag from which it is selected. This permits an adequate retrieval on the basis of aspects. A stop list containing small words and certain adverbs is used in order to avoid pollution of the on-line indexes by non-significant words. However, in the case that all the words of one tag are in the stop list, all of them will be included in the on-line indexes. A word figuring in the stop list is taken over into the on-line indexes when it is encircled by special characters.

4.4 Data retrieval

4.4.1 General principles

Records can be retrieved in the authority file and in the ISBD file. Moreover, we offer the opportunity to display the on-line indexes. Starting from a record containing links, the linked records can be displayed on the screen.

Access to a specific on-line index is indicated by a three character chain, called the aspect. This aspect is followed by the search term. The maximal length of a search question is 80 bytes. In case of personal author, the surname and the Christian name must be separated by a comma. The use of Boolean functions increases considerably the retrieval possibilities of NEWWAVE. A blank or a plus sign between the search terms means the Boolean AND-function whereas the equal sign identifies the Boolean OR-function. Not only different search terms within one aspect but also aspects grouping several search terms can be combined by the Boolean function. A name or a word can also be truncated : this is done by indicating a dollar sign at the end of the

search term.

If there is only one record answering the retrieval question, the record is displayed directly on the screen. If there are more answers, a list of records in abbreviated form, called short list, is presented. The elements of the short list are sorted according to the identification numbers of the records. The short list consists of one or more screens (pages), each of them containing only essential information from 21 records. The query command 'SN' asks for the next page of the short list. The records from the short list can be displayed one by one when using the skip technique (command 'SK'). Separate records can be picked up too, with the send-line technique.

The send-line technique is one of the most powerful retrieval features of NEWWAVE. It provides the user with an easy access to one or more records related to the contents of one line of the screen. The corresponding query command is 'SL' and the character 's' is placed in the first column of the selected line. The result of the operation depends on the actual screen contents. In case an index word list is displayed the send-line command will give the short list of the corresponding records. The send-line function performed on the short list or on a tag containing a link with one record will result in the display of the record selected. The short list of the records will be displayed when a tag containing the number of linked records has been selected with the send-line command.

The possibility of direct switching from one record to the related record(s) provides the user with a lot of useful and easely obtained information. This is illustrated with the following examples :

- the switching from an ISBD record to one of the authors and from this author to all his publications
- the switching from one monograph to its series record and from this record to all the linked monographs and
- the moving through the structure of a complex monograph.

4.4.2 Authority data retrieval

The query command to be typed in is 'AA'. In the authority file records of different types are searched for by the following aspects :

PER : personal author
COR : corporate author
UNI : uniform title
UIT : publisher and
OND : subjects.

In case more than one record answers the question a short list is generated. As explained above separate authority records are obtained by the skip or the send-line technique. In the authority record the number of linked ISBD records is given in tag 955. Selecting this tag with the send-line function gives directly the short list of the linked ISBD records.

The send-line technique is used also to display a related record (see-also reference for corporate names, uniform titles and subjects, narrower or broader term for subjects).

4.4.3 ISBD retrieval

The query command to be typed in is 'AT'. Bibliographic descriptions can be retrieved while using the following aspects :

PER : personal authors
COR : corporate author
TIT : title(s), except periodical titles
CCP : title of a periodical and
SUJ : subjects of the Belgian Bibliography and of the TEST and MESH thesauri.

The short list contains the titles of the corresponding records. The complete ISBD records are displayed by the skip or the send-line technique. The send-line command can be performed on all the tags containing single or multiple links either to authority records or to ISBD file records.

We want to draw your attention to the double use of the aspects 'PER' and 'COR'. The same aspects are used for retrieval in the authority file and in the ISBD file. In fact, both aspects access the online indexes of the authority file in order to find the author record(s). In case the code 'AA' is given a short list of author names is displayed, whereas with the 'AT'-command retrieval is made in order to find all the ISBD records of the publications written by these authors.

4.4.4 On-line index browsing

The query command is 'AL'. Its combination with one of the aspects cited above causes a display of the on-line indexes. The screen presents the index words followed by their frequency of occurrence. The corresponding records (authority or ISBD) can be displayed using the send-line technique. Index browsing gives the librarian an idea of the contents of the index files and offers him the possibility to adapt the retrieval question in a suitable way, for instance by choosing an efficient truncation.

5. Batch output

Records from the database can be printed as listings or as standard library cards. We also prepare magnetic tapes for COM, phototypeset printed publications or laser printer listings. These magnetic tapes are treated in service-bureau.

The records are selected from the database either on the identification number or on the fixed field information. Sort keys can be produced for nearly every tag of the record, which can be considered as a main entry : personal author, corporate author, title, subjects, UDC, series title, publisher, shelf mark.

6. The database content

6.1 The Belgian Bibliography file

The Belgian Bibliography file represents 90.000 titles. All the books and periodicals cited in the Belgian Bibliography since 1975 are grouped into the database.

The scope of the file encompasses all intellectual levels : scientific books as well as vulgarization works, fiction and juvenile literature. The main output form is a phototypeset printed publication. The Belgian Bibliography is a monthly publication which is annually cumulated.

The fact that NEWWAVE also treats non-book materials is illustrated by the publication of two supplements to the Belgian Bibliography namely one for cartographic materials and a second for printed music.

Recently a Belgian C.I.P. project has been started. Contacts are

made with the Belgian publishers and the bimonthly publication of a newsletter of books in print is foreseen for the autumn of 1983.

6.2 The library of the National Archives

Collaboration with this library started in the middle of the seventies and 50.000 titles are in the system. The original manual subject classification was based on UDC-indexing and was continued in the automated system. The library owns a collection of books on history and archivistics. Batch output provides microfiches according to UDC, geographical UDC, author, title and series title.

6.3 Dissertations

The Royal Library obtains dissertations by international exchange. Most are sent by German universities. Nearly 15.000 dissertations are stored in the database. The batch output are standard library cards. As a special feature of this application the processing of the affiliation information has to be mentioned. The affiliation is the university where the dissertation is presented. This organization is entered in tag 110 with an intellectual responsibility indicator 'z' and printed as an annotation.

6.4 Key to Belgian Science

The Key to Belgian Science is a bibliography of analytical publications, concerning exact and applied sciences, in Belgian periodicals. It is published annually, on microfiches. Subject indexing is based on the TEST and MESH thesauri. The data entry of the articles started in the beginning of 1983 and nearly 6.000 bibliographic descriptions are stored in the database.

6.5 The library of the American Center

The library of the American Center owns a collection of books on North American authors and literature. Indexing is based on Library of Congress Subject Headings. Some 6.000 books are stored within the data base.

6.6 Library of Congress Subject Headings

The development of the trilingual Library of Congress Subject

Headings authority file is in progress. For the translation into French the Laval (Canada) terms are used if appropriate, whereas the Dutch translation is original. There are different reasons for choosing the Library of Congress Subject Headings as a basis for the subject authority file. Indeed the manuel subject system of the Royal Library is in some way based on the Library of Congress Subject Headings. Moreover, this indexing system is playing more and more an international role. This is proved by the fact that translations are made into French in Canada and in France and into Spanish in South America. Further, as 40% of the acquisitions in our institution are English and 30% are French. It is hoped that through the CIP-program, in the future Library of Congress Subject Headings will be available in most of the books to be catalogued.

Until now only simple subject headings are entered. The subheaded subjects will be added later, linking the records of the composing parts. Some 12.000 records are introduced into the database and the following disciplines are completed : medicine, languages, literature and music. The music part is operational in the Music Section. For the catalogue in the reading room it has been decided to maintain the existing manual subject catalogue until most of the Library of Congress Subject Headings will be available in NEWWAVE. The new system will be gradually implemented according to the completion of certain well defined domains.

7. Further development of the system

NEWWAVE, in its actual state, is a powerful cataloguing tool with extensive retrieval capabilities. In order to achieve the final goal, which is an integrated system with networking facilities, it has to be extended with the other library functions. At the same time the technical part of the system has to be improved in order to guarantee a high quality on-line service to the constantly growing number of users.

The decision has been taken to use a commercial data base management system as the basis for all future developments. Different systems have been investigated and finally SESAM, a Siemens DBMS, based on a relational data model, was selected.

For the moment we are converting our data base into the SESAM internal format and we are adapting the on-line software to this new format.

It's not our intention to summarize here all the features of the data base management systems but we want to mention some evident advantages.

The use of a DBMS implicates immediately the improvement of the data protection (passwords on the different levels) and data security (logging function, restart facilities in case of a system breakdown and the recovery aids to assist the eventual reconstruction). Data independence and data consistency are increased.

The powerful retrieval capabilities give us the possibility to add a lot of functional improvements and new features with little programming effort. For example a sequential search can be applied to all the fields, which means that some already existing search possibilities can be enhanced by combining them with a sequential search on one of the non-indexed fields (publication date, owning library etc.). Short lists can be sorted according to different criteria (the numbering of monographs within series, publication date etc.). A large set of different utility routines facilitates the maintenance and the enhancements of the data base and of the system and provides us with the statistics about them.

Because the improvement of the technical part of NEWWAVE is realized by SESAM, the programming effort can be concentrated on the extensions of the system. Priority has been given to the integration of the acquisition function. The design of the local data for the acquisitions is already finished and will be incorporated once the converted system becomes operational. Afterwards the other library functions can be implemented.

The conversion of records from other libraries (Library of Congress, the Royal Library of the Netherlands) is planned. These records will be added to the data base and will serve as cataloguing aids.

In order to enlarge the batch output possibilities the purchasing of the SESAM report generator is considered.

8. Examples

In order to clarify some of the points described in the paper, we have included a few examples. The bibliographic descriptions are presented in the display format.

The first example is an ISBD record. The tags 100 contain references to the personal name authority file. Apparently, for this publication the imprint form on the title page is not identical to the one in the authority file, so a tag 260 has been added complementary to the authority file link, given in tag 270.

The second example presents a bilingual corporate body functioning as author and as publisher. The double function is indicated in the fixed field. The number of linked ISBD records is given in tag 955.

A subject authority record is shown in example 3. The record contains links to a related term (tag 701), to narrower terms (tags 704) and to a broader term (tag 705).

Examples 4-6 show the bibliographic descriptions of some items in the hierarchical structure of a complex monograph. The highest level description is given in ex. 4. Note that the lower level descriptions of this item are indicated in the tags 924, with an indicator giving its level within the hierarchical structure. An intermediate level description is given in ex. 5 : it is linked with two lower level items. The link to the immediate higher level item is indicated in tag 224. Ex. 6 gives one of the lowest level descriptions. In both the examples 5 and 6 the tag 925 indicates a link to the highest level record of the complex structure.

SK S: L: N:13-01-83 BB -NN
K:02-02-83 BB -R

MON: MAT: EXP: IMP: IMP: REF: DAT 1982 FAC
NAT:NB LANG:DUT

VERT:x NIV:s FIC: SER: PER: C: R:U

0000 161097
004A M030682-000978
005A D/1982/0108/0221
010A V 1.978 A
020A 90-201-1129-9 : 960 F
100A [034158] Zaks, Rodnay
100Bt [034235] Zorn, H.
100Cr [127393] van Prooijen, J.P.A.
245A Microprocessors van chip tot systeem / Rodnay Zaks ;
[vertaling : H. Zorn ; redactie : J.P.A. van Prooijen]
250A 2 = 2e opl.
260A Deventer ; Antwerpen : Kluwer technische boeken
270An [005541] Deurne : Kluwer technische boeken
275A dep. 1982
290A 375 p. : ill. ; 22 cm
545A o ORIG. TIT. : Microprocessors from chips to systems
660Af Ordinateurs, hardware
660Bn Computers, hardware

Ex. 1 : ISBD-record

```
 AA                                S:    L:   N:25-03-82  TST-NN
                                                K:25-04-83  BB -KK
TYP:C  AUT:X EDIT:X   DAT: -   NAT:BL LANG:FRE  TR:!  OFF:F

0000 046682
110AF «BELGIQUE»MINIST`ERE DES AFFAIRES <ECONOMIQUES . SERVICE
INFORMATION ET PROTECTION DU CONSOMMATEUR<<BRUXELLES»
&&FRE
110BN «BELGI>E»MINISTERIE VAN ECONOMISCHE ZAKEN . DIENST
INFORMATIE EN BESCHERMING VAN DE VERBRUIKER<<BRUSSEL» &&DUT
111AF SERVICE INFORMATION ET PROTECTION DU CONSOMMATEUR
«BRUXELLES» &&FRE X
111BN DIENST INFORMATIE EN BESCHERMING VAN DE VERBRUIKER
«BRUSSEL»&&DUT X
112AF MINIST`ERE DES AFFAIRES <ECONOMIQUES . SERVICE INFORMA
TION ET PROTECTION DU CONSOMMATEUR<<BELGIQUE»<<BRUXELLES»
112BN MINISTERIE VAN ECONOMISCHE ZAKEN . DIENST INFORMATIE
EN BESCHERMING VAN DE VERBRUIKER<<BELGI>E»<<BRUSSEL»
115AF BRUXELLES : MINIST`ERE DES AFFAIRES <ECONOMIQUES .
SERVICE INFORMATION ET PROTECTION DU CONSOMMATEUR
115BN BRUSSEL : MINISTERIE VAN ECONOMISCHE ZAKEN . DIENST
INFORMATIE EN BESCHERMING VAN DE VERBRUIKER
800AF BRUXELLES (1040)
800BN BRUSSEL (1040)
801AF RUE DEMOT, 24-26
801BN DEMOTSTRAAT, 24-26
805A  2295
955A 00002
```

Ex. 2 : CORPORATE BODY RECORD

AA S: L: N:08-02-83 BB - CUL
K:13-04-83 CO -EP

TYP: AUT:S EDIT: DAT:YW - NAT: LANG: TR: OFF:

0000 129185
650AE MUSICAL INSTRUMENTS [ELECTRONIC]
650BN MUZIEKINSTRUMENTEN [ELEKTRONISCHE]
650CF INSTRUMENTS DE MUSIQUE <ELECTRONIQUES
651AE ELECTRIC MUSICAL INSTRUMENTS
651BE ELECTROPHONIC MUSICAL INSTRUMENTS
651CN ELEKTRISCHE MUZIEKINSTRUMENTEN
651DF INSTRUMENTS DE MUSIQUE <ELECTRIQUES
652AE ELECTRONIC MUSIC INSTRUMENTS
701A [135943] ELECTRO-ACOUSTICS = ELEKTRO-AKOESTIEK = ELECTRO"ACOUSTIQUE
704A [129739] CLAVIOLINE
704B [129812] ELECTRONIC HARPSICHORD = ELEKTRONISCH KLAVE CIMBEL = CLAVENIN <ELECTRONIQUE
704D [129813] ELECTRONIC PIANO = ELEKTRONISCHE PIANO = PIANO <ELECTRONIQUE
704E [129102] ONDES MARTENOT = ONDES MARTENOT = ONDES MARTENOT
704F [129718] TRAUTONIUM
705A [129177] MUSICAL INSTRUMENTS = MUZIEKINSTRUMENTEN = INSTRUMENTS DE MUSIQUE
911A L.C./X/LAVAL
955A 0000

Ex. 3 : SUBJECT AUTHORITY RECORD

```
 SK                                S: L:  N:19-04-83  ARC-www
                                          K:19-04-83  ARC-www

MON: T MAT:   EXP:   IMP:    REF:   DAT1975   FAC
                                    NAT:BL   LANG:FRE
VERT:    NIV:   FIC:         SER:   PER       C:    R:


0000 168400
012A  4B01780
245A  $La$ _Wallonie : le pays et les hommes
270Af [000076] Bruxelles : $La$ renaissance du livre
275A n1975-1981
290A  28 cm
924A2 [168401] 0010- = : _Histoire - _<economies - _
soci<et<es
924B3 [168439] 0011- = Tome I : Des _origines `a 1830
924C3 [027903] 0012- = Tome II : De _1830 `a nos jours
924D2 [168402] 0020- = : _ Lettres - _arts - _culture
924E3 [168446] 0021- = Tome I : Des _origines `a la fin du
XVe si`ecle
924F3 [022517] 0022- = Tome II : Du XVIe si`ecle au lende
main de la Premi`ere _Guerre mondiale
924G3 [028488] 0023- = Tome III : De 1918 `a nos jours
```

Ex. 4 : MULTI-VOLUME MONOGRAPH :
HIGHEST LEVEL DESCRIPTION

```
SL                                S: L:  N:19-04-83  ARC-www
                                         K:30-05-83  ARC-www
MON: I  MAT:   EXP:   IMP:  REF:   DAT1975     FAC
                                   NAT:BL  LANG:FRE
VERT:   NIV:   FIC:     SER: PER:          C:   R:
0000 168401
012A N4B01780A
100A  [020315] HASQUIN, HERV<E
224A  [168400] @LA@ _WALLONIE : LE PAYS ET LES HOMMES ; 0010- =
245A  _HISTOIRE - _<ECONOMIES -  _ SOCI<ET<ES / DIRECTION
SCIENTIFIQUE : HERV<E HASQUIN
275A  1975
290A  2 VOL.
924A3 [168439] 0011- = TOME I : DES _ORIGINES `A 1830
924B3 [027903] 0012- = TOME II : DE _1830 `A NOS JOURS
925A  [168400] @LA@ _WALLONIE : LE PAYS ET LES HOMMES
```

Ex. 5 : MULTI-VOLUME MONOGRAPH
AN INTERMEDIATE LEVEL DESCRIPTION

```
SL                                S: L:  N:19-04-83  ARC-www
                                         K:30-05-83  ARC-ccc
MON: L  MAT:   EXP:   IMP:  REF:   DAT1975     FAC
                                   NAT:BL  LANG:FRE
VERT:   NIV:   FIC:     SER: PER:          C:   R:
0000 168439
012A N4B01780A/01
224A  [168401] _HISTOIRE -  _<ECONOMIES - _SOCI<ET<ES ;
0011- = TOME I
245A  DES _ORIGINES `A 1830
275A  1975
290A  468 P. : ILL., CARTES
925A  [168400] @LA@ _WALLONIE : LE PAYS ET LES HOMMES
```

Ex. 6 : MULTI-VOLUME MONOGRAPH
A LOWEST LEVEL DESCRIPTION

IFLA 1983

IFLA GENERAL CONFERENCE MUNICH 1983

Division: Management and Technology

Section: Information Technology
Biological and Medical Sciences Libraries
Social Science Libraries

5-SPEC-2-E
INF

Impact of Technology on Librarians

by

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The impact of information technology on librarians is seen as a number of convergent or congruent paradigms: increased use of technology leads in turn to new understandings of approaches to information and hence to new information needs; hierarchical organizational structures are disintegrating and are being replaced by a great variety of personal and professional networks in which emphasis is placed on the need to communicate; library users are changing and their needs are shifting; the library's role and functions are being redefined. The interaction of all of these turbulent areas breeds the requirement for a new type of librarian who is equipped personally and professionally to adjust to constant change. Library schools and libraries must be willing to assume new responsibilities as facilitators of change. There are many reasons to expect that they will.

The computer appeared in the library in the 1960s, at first in cataloguing and loans. When on-line terminals were introduced late in the decade, many library catalogues were set up as data bases, and many indexing and abstracting services generated data bases as by-products of their printed publications. In the 1970s full-text retrieval systems began for newspaper articles and legislative texts. There was much talk of electronic journals and of the paperless society. The 1980s are leading into knowledge-based systems which will provide access to different levels of substantive information assembled by leading experts in a given field (1). Such knowledge bases will someday be available on individual work stations costing less than five thousand dollars. Entire encyclopedias, colour reproductions of museum holdings, educational programmes and catalogues of major libraries will be disseminated on lightweight videodiscs costing ten dollars (2).

We are engaged in a developmental spiral, which really only began a short time (two decades) ago. The technology has influenced the patterns of knowledge workers who have in turn influenced the technology. Some old information seeking activities have become unnecessary. Some old means for accessing and

gathering distributed information, and disseminating information are being replaced by new alternatives, such as electronic mail, electronic journals, electronic meetings, etc. The specific effects of such augmentation depend on the process being augmented, the way it is augmented and how the knowledge worker perceives the augmentation. It is clear that this may change the way work is done, the knowledge it is based on, its goals, the information that is sought, and how it is sought. Therefore, today's needs within some professional communities do not necessarily represent their needs of tomorrow in an augmented environment (3).

We are constantly bombarded with information on new technology. Perhaps we wonder what it means for us, in our personal lives and in our place of work. Most of all, perhaps we wonder what impact we can make. It may strike us as curious that so many books are emerging almost simultaneously on these and closely related questions (4), (5), (6). The "Cognitive Paradigm" (7) provides some interesting insight. Read chapter seven ("Bibliometrics and the Structure of Science), chapter eight ("Informal Communication and Invisible Colleges) and chapter nine (The Life Cycle of Specialities). These can provide us with some "powerful ideas" (see also Seymour Papert (8) who is relevant too!) to equip us to better understand where we are now and how to prepare ourselves for becoming facilitators of change.

Naisbitt addresses some of these issues in less "scientific" terms: "In an information society - for the first time in civilization - the game is people interacting with other people. This increases personal transactions geometrically, that is, all forms of interactive communication: telephone calls, checks written, memos, messages, letters, and more. Whenever new technology is introduced into society, there must be a

counterbalancing human response, or the technology is rejected. At almost exactly the time we first introduced television, we created the group-therapy movement, which led to the personal growth movement, which in turn led to the human potential movement. Jet airplanes, as far as I can tell, have led only to more meetings. The more technology we introduce into society, the more people will congregate, will want to be with other people. Networks offer what bureaucracies can never deliver - the horizontal link. What occurs in a network is that members treat one another as peers - because what is important is the information, the great equalizer. Networks cut diagonally across the institutions that house information and put people in direct contact with the person or resource they seek." (5)

Up until now, computer technology has been used mainly in technical processing. Many of the tools which have been developed, such as MARC, or co-operative services or networks such as OCLC or WLN, were designed by librarians for use by other librarians. They were designed as tools to improve productivity. It can be argued that without them libraries would be in even worse shape in times of severe budgetary constraints than they are. Be that as it may, the accent must now be shifted to using the technology to provide new tools for the users of the library.

In the terms of the computer specialist, existing catalogues and search systems must be made more "user-friendly", that is, easier for non-librarians to employ (9). It is possible, for example, to purchase software packages that enable owners of personal computers to use the services of major on-line vendors without undergoing special training. A number of videotex-like systems exist which can take the user by the hand, so to

speak, and lead him or her to desired information through a series of menus. Present or future visual telecommunications services, using broadcast or cable TV, videotex, teletext and teleconferencing will develop in the following areas: entertainment, news services, information retrieval, shopping transactions, remote education, library service, utilities and financial services, protection of life and property, small group interactions, participative government, hard copy extension of display type services and work at home (10).

Traditionally, library catalogues lead to books, or other resources in the library's possession. Many users also turn to the library in search of specific information, or for general help. Perhaps the reference librarian, in guiding the user, may need to turn to other sources than the physical documents housed in one particular library. Computer and telecommunications technologies, together with the intellectual tools developed to assemble, analyse, store and disseminate information, can now be exploited by the librarian to provide new and improved services. These may include linking individuals and groups to provide access to information or for facilitating communications, i.e. putting people in touch with people (11).

The library should now be perceived as a community information resource. "Community" may be defined as a geographical entity, such as a town, city or county. It may be defined as a bureaucratic entity, such as a government department, or it may be an enterprise, a university, a research establishment, and so on.

The Pikes Pike Library District in Colorado has developed a number of community resource files. These include a calendar of events that are open to the public in the community, directories of

social service agencies, clubs, adult education courses, and recreational activities. These files, together with the library's on-line catalogue, are all accessible on a computer system called Maggie's Place (12). The main library and its branches are equipped with some 15 public access terminals for users to directly search the data bases. In addition, over 600 library users have their own personal computers which can access many of these files from their homes. The library also maintains on-line files of the day-care centres in the community, an on-line car pool matching system and a bus information system.

Library use of videotex in a community setting has started on a modest scale in the United Kingdom (13). Private videotex systems can be designed for use in-house within an enterprise. Such videotex systems must be easy to use, always be available (24 hours a day if possible), be properly indexed so that users can be led quickly to desired information, be capable of showing an organization's activities succinctly in a clearly understandable way and present information meaningfully by skillful use of colours, text and graphics (14). In a library setting, such private videotex systems offer a number of advantages over nation-wide systems, in particular because they can be managed to standards of reliability determined by local needs (15).

It should be clear from the preceeding paragraphs that libraries in all settings (public, company, government, university, research) are undergoing change. If they are not, this is an indication that something is wrong! How efficiently we operate our libraries in the future depends on how well we manage our resources, on how well we provide access to information, and most of all, on how well we communicate (16).

Some of us are perhaps not prepared for such change. It might be argued that, after all, Colorado Springs is not a "typical" community; some of the things they are doing might not be done for years in other settings. That is running away from reality. After all, in the United States it took approximately 50 years for 50 percent of the homes to acquire telephones, about 8 years for 50 percent of the homes to have television, and within 5 years about 50 percent of the homes will be equipped with personal computers. Referring to John Naisbitt again: "The rapid change ahead also means that you cannot expect to remain in the same job or profession for life, even if it is an information occupation. The coming changes will force us to seek retraining again and again". If the library schools are not (or cannot) provide the training we require to cope with change, we will search for training elsewhere. In the final analysis, we must summon within ourselves the will to devote our energies to understanding the new problems and search for new solutions to these emerging problems. If we do, however, we can be comforted by the fact that we are not alone.

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Advancing Technology: The Secondary Impact on Libraries and Users

by

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Advancing technology is affecting the daily lives of people all over the world. While technology, the art of applied science, includes many amazing advances and discoveries, it seems to this author that three technologies - transportation, communication and computerization - stand above all of the others. The jet-powered aircraft has reduced the barrier of geographic distance for the modern traveler and has brought the peoples of the world into close proximity. The satellite has allowed virtually instant communication between two points anywhere on the globe. The computer, the most powerful of the new technologies, has extended the abilities of the human brain to capabilities unforeseen several decades ago. Futurists, those persons who use the rapidly-changing events of the present to predict the events of the future, forecast a new era ranging from the global village of Marshall McLuhan[1] to the future shock of the third wave seen by Alvin Toffler[2].

In his book, The Third Wave, Toffler makes the point that historical change occurs in waves of technological progress. He describes the first wave as the agricultural revolution and the second wave as the industrial revolution. The third wave, which is advancing upon us, is a new civilization arising out of the fabric of a re-woven society. Whether Toffler is right or wrong, this author believes that the analogy of waves he employs is useful for describing the impact of technology on society. If one stands in the ocean near the shore with the sea's waves breaking nearby, one can see that large waves are not an isolated physical phenomenon. Large waves are supplemented by a series of smaller waves, each of which has its own impact on the shoreline. This author submits that the impact of technology is the same in that there are many forces acting simultaneously and in different ways, which one might describe as primary and secondary.

Primary Impact

Technology makes a primary impact. By this the author means that change is visible and intense. Using the illustration of advanced technology in transportation, a primary impact of the jet-powered aircraft has been to shorten travel times around the world. Another primary impact of this technology has been to make accessible parts of the globe that previously were inaccessible to one degree or another. Similar examples can be made for the other two major techological advances of the latter half of the twentieth century, the communications satellite and the computer. For the former, a primary impact has been achieving the ability to link together people separated by vast distances without moving the people, but rather transmitting their words. For the latter, a primary impact has been gaining the ability to process, store and retrieve information and data well beyond the speed and capacity of the unaided human mind.

Secondary Impact

Technology also makes a secondary impact. By this the author means the less visible changes that tend to have far-reaching consequences for the serious issues facing civilization. While the jet aircraft may open new possibilities for global travel, the very fact that such travel is available not only to the former travel-elite, but to anyone who can afford the price of a ticket and obtain a passport and visa creates tensions in the society both at the departure point and the destination. At home, the expression "Travel broadens the mind" is most appropriate and will foster increased demands to learn more about other parts of the world. From another perspective, the economics of mass transportation are most important as the industry creates jobs. Another example of a secondary impact of the technology is the creation of noise pollution for people who live near major airports that are served by the large jet transports.

In communications, one can see a secondary impact through the effect on traditional social values in communities isolated from cosmopolitan cultures once they are exposed to mass-media such as television, with its capacity to educate, entertain and confuse. For computers, the questions on secondary impacts loom large in the minds of thoughtful persons. While massive quantities of data can be manipulated rapidly with modern computing machinery, the question remains - what data? Who will select the data?

Technology in Libraries

Few librarians today will dispute that the advancing technologies in communications and computerization are having a significant impact on libraries and their users. Libraries are central institutions in many societies. At a time when technology is changing society as a whole, it must also change libraries. This author submits that those changes will be in both form and function. Using the approach established above to examine the impacts of technology, one can surmise that advancing technology will have both primary and secondary effects on libraries and their users.

The present literature contains many writings about the primary impact of technology on libraries. The advent of the computer in libraries has progressed well beyond its early stages to advanced techniques in bibliographic control, resource sharing between and among libraries, and preservation of library materials. The computer and its linking mechanism, telecommunications, have altered the basic processes in libraries to the extent that new forms are arising out of old and new functions are appearing where before others were. Reference services now are available through online subject information retrieval systems as well as in the traditional ways. Cataloging has evolved in some countries to the point where only a

few libraries do extensive cataloging and make the records accessible to many other libraries. The examples of the primary impact of technology are numerous.

Less clear is the secondary impact that technology is having and will continue to have in the future. Futuristic technologists such as Toffler would have us believe that libraries, which were created to store systematically the common mass memory of civilization, are so bound to conventional thought processes that they cannot take part in the transition to a community of individual electronic cottages as he sees society structured in the future. This author suggests that of the many secondary impacts that libraries and their users may feel from technology, there are three that have particular importance and form the focus of the discussion through the remainder of this paper. These are the impact of technology on library buildings, on the place of libraries in society, and on the preservation of library materials.

Library Buildings

Despite the common folk-wisdom among many people, libraries are not buildings. Libraries, in fact, are collections of library materials gathered in a variety of formats and accessible for a variety of purposes. The services of a library are derived from those collections. Nevertheless, buildings are important to libraries, at least until library information is stored solely in electronic impulses and telecommunications eliminates the need for a centralized place in which to connect library services with library users. From before the Alexandrian Library to today's great and active storehouses of the knowledge of mankind, the library building has been carefully designed and maintained to house and preserve the library's collections as well as provide a pleasing environment for the library's users. Few scholars will deny that the surroundings are less important than the collection.

These two central roles of the library building perhaps lead to their own shortcomings. The continuing proliferation of publications has resulted in an overcrowding of libraries. The increasing burden of more materials detracts from the efficiency of housing and preserving the collection. More users create more demand on the collections and on the buildings. Can the advancing technology solve these problems? The futurists suggest that libraries and library buildings as we have known them are changing. This change seems to this author to be in three parts.

First is the impact on library buildings of technological development up to now. Few librarians have the good fortune to be able to walk away from their present buildings coincidentally with the installation of new technology: computers and telecommunications. For most libraries new technology at this stage of its development means renovation or physical changes in present buildings. Without adequate conduits and incoming electrical power, costly and substantial modifications have been required to allow existing library buildings to accommodate numerous new telephone lines, computers, whether mainframe, mini or micro, video display terminals, and the like. Such patchwork renovation is always more costly than utilizing new construction in terms of manpower, equipment and inconvenience to librarian and user.

Second is the impact on library buildings of technological development during a period of transition from little technology through add-on technology to the advent of serious re-thinking of the processes employed in libraries. At a time in which more and more library buildings are remodeled or newly constructed to accommodate either large-scale independent technical operations or linkage to large centralized processing operations, future directions appear to point out the increasing values of distributed processing and local self-contained functionally-based processors for circulation, cataloging and other library processes. In other words, library buildings are being made

ready for libraries to be nodes in vast networks of libraries while, at the same time, librarians begin to consider other structures for technology.

Third is the impact on library buildings of technological development which may mean the elimination of library buildings. If Toffler's electronic cottage materializes, it will mean that all data and information, possibly past, but assuredly present and future will be stored electronically. It will mean that library users will use information, whether contained in present or future versions of libraries, from their homes via electronic telecommunications. Therefore, no collection storehouses will be needed, but will be replaced by computer files in mass storage media in densities beyond present comprehension. Therefore, no library buildings will be needed by library users, their access will be entirely from home.

It can be seen that the impact of advancing technology on library buildings is and will be great. Will libraries become museums of the book staffed not by information intermediaries, but by curators of artifacts? Will archives disappear as a result of being taken over by the electronic notebook? Will browsing, the great tool of serendipitous scholarship, become a lost art?

Libraries in Society

Libraries are an important thread in the fabric of society. Virtually every type and size of library from the vast research libraries supporting scholarly endeavors to the urban public library's neighborhood branch housed in a former shop, libraries render a public good and often in remarkably inexpensive ways. Each of the types and sizes of libraries can be described as to its role in society. Therefore, each can be examined as to the impact of technology on that role. To remain within the limitations required of it, this paper will describe the role of the research library in the process of scholarly communication and examine the impact technology is having on that.

Scholarly communication is the process by which the thoughts of a scholar reach the mind of another scholar. Many works have described the process in great detail. Borrowing from these descriptions, this author will concentrate on that portion of the system which most involves libraries, the portion involving written, and particularly published documentation. In the simplistic system described here, the authors and the readers can be considered as the same persons. The author translates his thoughts into written words, which are organized, reproduced and distributed by editors and publishers. Libraries are the storers and preservers of the scholarship, but also play an important role in organization and distribution, which is the source of a growing conflict between libraries and publishers as the economics become less attractive. The authors as readers complete the transfer of knowledge cycle.

Needless to say, with so many data- and communications-oriented processes, technology will have a strong impact on scholarly communication. One scenario that has been proposed is that libraries will no longer be needed in this cycle. Advancing technology will allow authors to prepare their manuscripts using text processing equipment. Editors will be able to review the text in its machine-readable and storable form. Publishers can eliminate the reproduction step and distribute the text to readers directly in electronic publishing vehicles. There is no role for libraries or librarians in this bleak scenario. The shortcoming of this is that no one performs the information intermediary role, which becomes more indispensable as more and more information is produced, and as the access points become more numerous and complex.

Therefore, this author suggests that as the distinctions between the various stages of the scholarly communication process become less clear and the use of technology increases throughout each stage, the need for the library becomes more acute. Without the librarian, the vast complexity of information becomes like a wilderness unexplored

and unknown. A present-day illustration is the large array of software available for the new personal computers - the information is there but unorganized and unfathomable. Technology will have a positive impact on librarianship in this instance by ensuring a stronger, more vital role in the process of scholarly communication.

Preservation of Library Materials

A principal issue in preservation of library materials is what to preserve. Technology can have a secondary impact on this issue. In a world in which information is created, stored, retrieved and delivered electronically, a central question arises about the preservation of grey literature and ephemeral materials. Computerized information files, no matter how dense the storage capacity, have a saturation point as do library buildings. Librarians will be essential to the process of deciding what can retained despite all of the recent statements about market demand as the primary means of deciding retention. A potential threat to libraries in the preservation of information is that the advancing technology could foster a point of view that libraries can only preserve the information of the past and cannot be active participants in the future use of technology.

Summary

Advancing technology has both a primary and secondary impact on society and its institutions. The purpose of this paper has been to explore the secondary impact of advancing technology, particularly computers and telecommunications, on libraries. The author has cited examples of the secondary impact of technology on library buildings, on the library is society, and on the preservation of library materials. The author has concluded that advancing technology will change both the form and function of libraries. Library buildings have three effects from technological development: the need to renovate old buildings to accommodate new technology; the problem of constructing

buildings for one form of technology while another is developing; and the potential that no library buildings may be needed in the future. The role of libraries and librarians in the electronically-based future is that of information intermediary, which is vital to the process of scholarly communication. This is particularly evident in the difficult problems facing the preservation of library materials.

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Der Einfluss zukünftiger Informationstechniken auf die Beziehung zwischen Mensch und Maschine

von

J. Heimann

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Der Einfluß zukünftiger Informationstechniken
auf die Beziehung zwischen Mensch und Maschine

Sehr geehrte Damen und Herren,

lassen Sie mich zunächst für die Ehre danken, vor diesem Kreis über eine technische Entwicklung sprechen zu können, von der ich überzeugt bin, daß sie das Faszinierendste ist, was sich Menschen bisher haben einfallen lassen, um ihre phylogenetisch (stammesgeschichtlich) bedingten natürlichen Fähigkeiten technisch zu unterstützen.

Entgegen dem ursprünglichen Plan, zu konkreten aktuellen Fragen im Grenzbereich zwischen der Technik einerseits und ihren medizinischen und soziologischen Wirkungen andererseits Stellung zu nehmen, werde ich mehr über das sprechen, was mit hoher Wahrscheinlichkeit in den nächsten Jahren auf uns zukommt und nicht über das, was uns heute im Wechselspiel zwischen Mensch und Technik bewegt und was in wenigen Jahren durch ganz andere Probleme abgelöst werden wird.

Dabei gehe ich davon aus, daß das Hauptproblem der modernen Menschheit nicht etwa ein Mangel an Informationen ist, sondern vielmehr das extrem hohe quantitative Informationsangebot, das die menschliche Konsumfähigkeit selbst im Bereich der Spezialliteratur weit überfordert, - von dem allgemeinen Informationsangebot der öffentlichen Medien einmal ganz abgesehen.

Diese Erscheinung hat heute in einigen Bereichen der Wissenschaft, der technischen Entwicklung und der Politik Formen angenommen, die die Leidtragenden vor die Alternative stellen, entweder zu forschen, zu entwicklen, bzw. zu entscheiden oder das Informationsangebot ihres Gebietes zur Kenntnis zu nehmen; beides zu vereinen,

gelingt jedenfalls in vielen Fällen nicht mehr. Dabei besteht das Hauptproblem weniger darin, neues Wissen zu absorbieren, als viel mehr darin, die Schafe von den Böcken zu trennen, sprich: das Wesentliche vom Unwesentlichen zu unterscheiden.

Meine Damen und Herren, genau hier erhebt sich die Frage, welchen Beitrag die Informationstechniken zur Lösung des geschilderten Konfliktes in der Zukunft leisten können und welche generellen Schwierigkeiten damit verbunden sind.

Die akuten Fragen, die sich in diesem Zusammenhang z.B. aus der Benutzung von Bildschirmarbeitsplätzen und ihrer ergonomischen Gestaltung ergeben, sehe ich dabei, - die Betroffenen mögen mir das verzeihen, - als, - wenn schon nicht gelöst, - so doch prinzipiell lösbar an. Die Berechtigung zu dieser Haltung leite ich von der Tatsache ab, daß - zumindest in diesem Lande - systematiche Untersuchungen der physischen und psychischen Belastungen, Versuche in Speziallabors und ein lebhafter Informationsaustausch zwischen Arbeitgebern und Gewerkschaften sowie zwischen Herstellern und Anwendern für eine stetige Anpassung der Technik an die Bedürfnisse der sie nutzenden Menschen sorgen. Daß dies nicht immer schon vorsorglich, zumindest aber nicht mit dem Tempo geschieht, das die Betroffenen erwarten, liegt u.a. daran, daß es sich bei der Arbeitsplatzgestaltung grundsätzlich nicht um eine einfache Folgebeziehung zwischen technischem Angebot und physischen sowie psychischen Reaktionen handelt, sondern vielmehr um eine komplexe Wechselbeziehung, bei der neben technischen Gesichtspunkten auch politische, ökonomische, soziologische, anthropologische und gegebenenfalls auch ökologische mitspielen; daß es mit anderen Worten der Erkenntnisse einerseits und der Kompromißfindung andererseits und damit der Zeit bedarf, um zu akzeptablen Lösungen zu kommen.
Es hieße gewiss, Eulen nach Athen tragen, wollte ich auf einem Kongreß von Biblothekaren auf die Rolle verweisen, die die elektronischen Datenbanken inzwischen bereits durch die Fachinformationssysteme spielen. Trotz der unzweifelhaften Vorteile, die sie

dort gegenüber der konventionellen Handhabung von Informationen bieten, zeichnen sich aber unverkennbar Grenzen ab, die mit den bisherigen Systemen nicht überschritten werden können. Im wesentlichen sind hierfür zwei Gründe maßgebend:

1. Menschen kommunizieren überwiegend mit Hilfe sogenannter "schwach formalisierter Information", d.h. mit den opto-akustischen Mitteln der Sprache und des Sehens unter Berücksichtigung von Kontexten.
   Elektronische Systeme arbeiten dem gegenüber bisher nahezu ausschließlich mit stark "formalisierten bzw. codierten Informationen", d.h. mit Ziffern, Buchstaben, Koordinaten und Symbolen, allenfalls noch mit Grafiken.

2. Menschliche Verhaltensweisen sind überwiegend begrifflich-assoziativ organisiert.

   Elektronische Datenbanken arbeiten streng determiniert und sind formal korrelativ organisiert.

Die sich aus diesen Unterschieden ergebenden Leistungsmerkmale von Mensch und Maschine lassen sich am überzeugendsten an Beispielen erläutern:

- Wenn ich eine bestimmte Information in einer elektronischen Datenbank suche, bin ich gezwungen, den Suchbegriff als Stichwort oder als eine Folge logisch miteinander verknüpfter Stichworte zu formulieren. Günstigenfalls abstrahiert das System von grammatikalischen Formen und berücksichtigt Synonyma, soweit diese vorher im "Thesaurus", also im Stichwortverzeichnis der Datenbank vorgesehen sind.

  Der Zuordnungsprozeß zwischen Suchinformation und gesuchter Information findet durch zeichenweise, formale Korrelation der, - gegebenenfalls auf die Wortstämme reduzierten,

- Zeichenfolgen statt.

- Wenn ich eine bestimmte Information in meinem Bücherschrank suche, erfolgt der erste grob orientierte Zugriff gegebenenfalls über die Farbe des Buchrückens, eine Erinnerung daran, daß sich die gesuchte Information rechts oben auf einer Seite befand oder über andere Kennzeichen, die mit der Suchinformation sachlich nicht notwendig etwas zu tun haben müssen.

- Ein besonders eindrucksvolles Beispiel für die Assoziationsfähigkeit des Menschen ist die bekannte Tatsache, daß man einen Bekannten, den man drei Jahre lang nicht mehr gesehen hat, auf 50 Meter Entfernung von hinten am Gang erkennen kann. Es dürfte klar sein, daß sich derartige "kognitive Prozesse" nicht durch formale Korrelationen optischer Bilder technisch nachbilden lassen.

Hier klafft zwischen den menschlichen Fähigkeiten und den bisherigen Möglichkeiten, diese technisch zu unterstützen, offenbar eine gewaltige Lücke. Darüberhinaus wird ein grundsätzliches Problem sichtbar, das das deutsche Synonym für Assoziationen, "Vorstellungs-Verknüpfungen", (im englischen vielleicht mit "combining imagination" übersetzbar), bereits an der Wortbildung erkennen läßt. Vorstellungen und deren Verknüpfungen sind nämlich an das Wissen, die Erlebnisse und die Erfahrungen von Individuen gebunden, daher nur sehr bedingt objektivierbar und damit natürlich auch nur bedingt automatisierbar. Nur wenn der Wertevorrat der betrachteten Informationsmenge hinreichend klein ist, ein relativ enges Fachgebiet betrifft und auch dieses noch in einem relativ engen zeitlichen Rahmen, können Assoziationen durch "formale Korrelationen von Begriffsbeschreibungen" hinreichend genau abgebildet werden.

Die Rolle des zeitlichen Rahmens ergibt sich dabei aus der Änderung der semantischen Inhalte von Wörtern als Funktion der Zeit: Wer würde heute noch einen Teenager unter dem früher in unserem Lande gebräuchlichen Begriff "Backfisch" zu finden hoffen? (Backfisch: "fried fish; poisson frit" übertragen "flapper; gosse, gamine").

Hieraus folgt zwangsläufig, daß jeder Ansatz in diesem Bereich leistungsfähigere technische Instrumente zur Verfügung zu stellen, den Weg der "objektivierten Automatisierung" verlassen und statt dessen den des subjektiv verwendbaren, - und wie der Hinweis auf die Änderung semantischer Inhalte zeigt, - auch zeitlich anpassbaren Instrumentes beschreiten muß.

Ich finde das übrigens außerordentlich beruhigend. Es bedeutet nämlich, daß die Entwicklung es nicht nur aufgrund moralischer, sondern auch aufgrund rationaler Überlegungen nahe legt, die persönliche Verantwortung der Individuen, die sich der elektronischen Informationsverarbeitung bedienen, in Zukunft hinter den Instrumenten wieder deutlicher sichtbar zu machen.

Wie dies grundsätzlich möglich ist und wie eng dabei die Kommunikationsmittel und die strukturellen Leistungen der technischen Systeme miteinander verknüpft sind, möchte ich zunächst am Beispiel des "Grafischen Arbeitsplatzes eines Architekten" erläutern.

Ein derartiger "elektronischer Arbeitsplatz" nimmt dem Architekten zunächst einmal die mechanische Arbeit des Zeichnens am Reißbrett ab, in dem er ihm den gleichen optischen Effekt sehr viel einfacher und schneller auf einem großen Bildschirm z.B. mit Hilfe eines "Lichtgriffels" zu gestalten gestattet. Er ermöglicht es ihm darüber hinaus, durch "einfachen Knopfdruck" den Entwurf auf dem Bildschirm zu verschieben, zu drehen, zu verkleinern oder zu vergrößern sowie auf einfache Weise zu verändern. Die modernsten Systeme sind schließlich sogar in der Lage, aus Aufriß, Grundriß und Seitenriß "automatisch" eine perspektivische Darstellung herzustellen, auch diese zu variieren und gegebenenfalls

sogar in eine Abbildung des vorgesehenen Standortes einzublenden. Die "Fähigkeit" zur perspektivischen Darstellung einschließlich z.B. der, bei der Drehung die dann durch den Vordergrund verdeckten Linien zu unterdrücken, - um nur eines der dabei auftretenden Probleme zu nennen, - ist von Experten vorher als Programm entwickelt und in das System eingespeichert worden. Es steht damit allen späteren Benutzern ohne deren Zutun zur Verfügung.

Die Wirkung derartiger Systeme geht aber weit über die vordergründige "Entlastung von mechanischer Zeichenarbeit" hinaus:

> Durch die zeitlich unmittelbare Rückkopplung zwischen gestaltendem Willen und Ergebnispräsentation wird die schöpferische Leistung des Architekten selbst, gegebenenfalls auch die seines Auftraggebers, angeregt.

Der Geschmack beider wird hierdurch allerdings nicht beeinflußt. Immerhin bin ich der festen Überzeugung, daß manches Stadtbild, - hätte man die skizzierten Möglichkeiten schon früher gehabt, - heute anders aussähe.

Meine Damen und Herren, die Arbeit mit einem derartigen elektronischen Informationssystem verhält sich zum Einsatz eines Rechners z.B. für die Buchhaltung, wie die Improvisation eines Pianisten am Konzertflügel zur Betätigung eines Leierkastens (engl.: barrel organ; franz.: Orgue de Barbarie).

Es ist in diesem Zusammenhang interessant zu bemerken, daß man beim Musikinstrument davon spricht, daß es jemand "spielt" und, - wenn er ein Könner ist, - daß er es "beherrscht". Diese Gegenüberstellung zeigt übrigens zugleich, in welchem Sinne das zuvor von mir erwähnte "Sichtbarwerden der persönlichen Verantwortung" gemeint war.

Systeme, die das Wissen und/oder - wie im obigen Beispiel, - das Know-how von Experten, Dritten interaktiv zur Verfügung stellen,

werden generell "Expertensysteme" genannt. Ihre Grundlagen werden im Rahmen der sogenannten "Künstlichen Intelligenz" erforscht.

Für die "Wissensverarbeitung" wurden solche Systeme bisher hauptsächlich für die medizinische Diagnose in schmalen Fachbereichen (z.B der Toxikologie), für die geologische Prospektion sowie für die Konfiguration und Überwachung technischer Großsysteme entwickelt.

Mir ist allerdings bisher kein Expertensystem bekannt, das dazu dient, die Arbeit eines Bibliothekars zu erleichtern bzw. seine Leistung als "Berater" zu erhöhen. Ich vermute, daß das weniger aus sachlichen Gründen als vielmehr aus wirtschaftlichen unterblieben ist. Dabei ist in meinen Augen offenkundig, daß der Weg zur Beherrschung der riesigen Informationsmengen, mit denen der moderne Mensch überflutet wird, schließlich nur dadurch gelöst werden kann, daß den Informationsvorräten und -Angeboten Expertensysteme zur technischen Unterstützung des assoziativen menschlichen Zugangsverhaltens zu Informationen, also zu ihrer Selektion und Bewertung vorgeschaltet werden. Dies erscheint zumindest für dasjenige Wissen und Know-how notwendig, das in öffentlichen und privaten Bibliotheken, in Patentämtern, Universitäten etc. das Kulturgut und den Wissensbestand der Nationen widerspiegelt.

Für aktuelle Informationen, wie sie bisher in gedruckter Form im wesentlichen durch Zeitschriften, Magazine o.ä. verbreitet werden, zeichnen sich zweifellos wesentlich einfachere Lösungen ab. Die strukturierten "Suchbäume des elektronischen Bildschirmtextes dürften hierfür weitgehend ausreichen. Wesentlich an diesem System bzw. an dem britischen PRESTEL-Dienst oder dem französischen Videotext ist, daß hier erstmals versucht wird, von der bisherigen "angebotsorientierten" zur "nachfrageorientierten" Versorgung mit aktuellen Informationen überzugehen.

> Prinzipiell wird durch dieses Vorgehen die Möglichkeit geschaffen, den Konsumenten die Redundanz der Informationsangebote zu ersparen.

Es bleibt abzuwarten, ob - und falls ja - in welchem Umfang das schließlich gelingt.

Es leuchtet ein, daß z.B. in der Fachliteratur eine rein "nachfrageorientierte" Informationsversorgung unzureichend ist, da ihr die Komponenten der "Anregung" und der "Verweisung auf neue Erkenntisse" fehlen, die nur schwerlich über strukturierte Suchbäume a la Bildschirmtext realisiert werden können. Nicht zuletzt deswegen bedarf es dort in jeder Hinsicht leistungsfähigerer Verfahren, um einen nützlichen Mittelweg zwischen Redundanzvermeidung, spezifischer Interessenorientierung des Konsumenten und Aktualitätsgrad des Fachwissens zu finden.

Der angedachte Weg, großen Wissensaggregationen Expertensysteme zur technischen Unterstützung der Selektion und Bewertung von Informationen vorzuschalten, wirft jedoch eine Reihe neuer Probleme auf, die mit der bereits erwähnten Tatsache zusammenhängen, daß menschliche Assoziationen grundsätzlich nicht objektivierbar sind, daß sie nicht nur von der sachlichen Zweckbindung, unter der sie erfolgen, sondern auch von den persönlichen Erlebnissen und Erfahrungen des assoziierenden Induvidiums abhängen:

> Jedes menschliche Verhalten in einem bestimmten Augenblick findet in einem einmaligen, nie wiederkehrenden Schnittpunkt zwischen Zukunftsorientierung und individueller Vergangenheit statt.

Die Assoziationen z.B., die sich mir mit dem Wort "Stacheldraht" aufdrängen, sind wesentlich von der Umzäunung eines Lagers am Stadtrand von Moskau geprägt; sie unterscheiden sich mit Sicherheit von denen eines Joggers, der versehentlich einmal über einen entsprechenden Zaun gestolpert ist.

Aus der Abhängigkeit menschlicher Informationshandhabung vom Handlungszweck und vom persönlichen, durch die Erfahrungen bedingten Assoziationspotentials folgt zweierlei:

1. Da jedes menschliche Verhalten zu neuen Erfahrungen führt, verändert sich das Assoziationspotential ständig und zwar nicht nur durch das quantitative Hinzutreten neuer assoziationsfähiger Objekte sondern auch dadurch, daß sich die Assoziationsbezüge qualitativ verändern.

2. Jeder Versuch, die menschliche Assoziationsfähigkeit technisch zu unterstützen, muß die Tatsache der zeitlichen und individuellen Veränderung des Assoziationsvolumens und der Assoziationsbezüge bereits vom Konzept her berücksichtigen. Systeme, die diese Eigenschaft haben, müssen sich daher durch eine extrem hohe dynamische Anpassungsfähigkeit auszeichnen.

Meine Damen und Herren,

Sie werden sich vielleicht fragen, weshalb ich diesen psychophysischen anthropologischen Gesichtspunkten mehr Aufmerksamkeit zuwende als der Technik?

Hierfür gibt es aus meiner Sicht eine Reihe von Gründen. Der wesentlichste ist der, daß sich die Technik derzeit entlang überschaubarer Linien entwickelt, und daß für die meisten der in naher Zukunft zu erwartenden Aufgaben, - zumindest vom Prinzip her, - Lösungen erkennbar sind. Hingegen besteht bis jetzt ganz allgemein noch keine klare Vorstellung darüber, welche Strukturen elektronischer Systeme am besten geeignet sind, höhere Formen intelligenten menschlichen Verhaltens technisch zu unterstützen als die derzeit vorherrschenden, vergleichsweise primitiven Routinehandlungen.

Mit an Sicherheit grenzender Wahrscheinlichkeit läßt sich sagen, daß sich höherwertige intellektuelle Fähigkeiten mit den herkömmlichen Strukturen, bei denen ein einfacher Instruktionsfluß einen einfachen Datenfluß steuert, nicht werden befriedigend technisch

unterstützen lassen. Man wird vielmehr wird zu Strukturen übergehen müssen, bei denen multiple Instruktions- und Datenflüsse zusammenwirken. Ein Hinweis hierauf läßt sich aus der Tatsache ableiten, daß das menschliche Gehirn, trotz der auf knapp 100 m/sek begrenzten Ausbreitungsgeschwindigkeiten von Informationen in unserem Nervensystem zu speziellen Leistungen fähig ist, die die leistungsfähigsten Rechner auch nicht annähernd erreichen und die daher nur durch "Parallelarbeit" erklärbar sind. Lösungen für Probleme, die sich auf die Eignung unterschiedlicher Computer-Strukturen beziehen, hängen daher entscheidend von grundsätzlichen Erkenntnissen ab und nur bedingt vom Mitteleinsatz.

Wie bereits erwähnt, sind die Verhältnisse im Bereich der Technik überschaubarer. Außerdem orientiert sich die Akzeptanz einer Technik durch die Benutzer und Nutznießer in der Regel weit weniger an ihren spezifischen Eigenschaften, als vielmehr an den Wirkungen, die von ihr ausgehen und an den Assoziationen bezüglich der Vor- und Nachteile, die die Betroffenen oder die sich betroffen fühlenden mit der Technik verbinden.

In diesem Zusammenhang spielt neben den bisher im Vordergrund stehenden Überlegungen zur Zuordnung von Suchinformationen zu den gesuchten Informationen vor allem die Übermittlung und Darstellung der identifizierten Informationen gegenüber den Interessenten eine Rolle. Zur Abschätzung des voraussichtlichen Trends ist es wichtig zu wissen, daß es in einigen Jahren weniger Aufwand erfordern wird, Informationen auf elektronischem Wege zu speichern, Interessenten an einem beliebigen Ort auszuliefern und dort mit "Buchdruckqualität" optisch zu präsentieren, als sie auf Papier zu drucken und materiell zum Empfänger zu transportieren. Die hierzu notwendigen Aufzeichnungsverfahren und Speichermedien stehen zum Teil bereits jetzt auf elektronischer, magnetischer und optischer Basis zur Verfügung. Satelliten und Glasfaserkabel werden den Transport auf breitbandigen Übertragungskanälen bis in die privaten Haushalte hinein übernehmen. Bildschirme, eventuell auch in flacher "handlicher" Form sowie preiswerte Faksimile-Geräte

werden die Wiedergabe am Empfangsort in einer Qualität ermöglichen, die weitgehend der der Originale entspricht. Auch die "Informationswandlung" von den Originalen in deren elektronische Abbilder wird keine grundsätzlichen Schwierigkeiten bereiten, da die Kostendegression auf der technischen Seite die bisher notwendige Codierung der Informationen überflüssig machen wird. Schließlich kann davon ausgegangen werden, daß sich die "Kommunikation zwischen Benutzer und System" in Zukunft weit stärker an den üblichen zwischenmenschlichen Kommunikationsgepflogenheiten orientieren wird, d.h. sich von der bisher überwiegenden Korrespondenz über die Bedienung von Tastaturen zu einer "opto-akustischen" durch "gesprochene Wörter" und "optische Rückkoppelung" gekennzeichnetem - System weiterentwickeln wird.

> Vom Prinzip her besteht damit die Möglichkeit, den Zugriff zu den in Bibliotheken, Patentämtern, Wissenschaftlichen Instituten etc. gespeichertem Kulturgut, Wissen und Know how aus der bisherigen Beschränkung der örtlichen, zeitlichen sowie darstellungsmäßigen Verfügbarkeit und Nutzung zu befreien und jedermann nach individuellen Kriterien zu ermöglichen.

Der wachsende Entwicklungsdruck, den die immer schwieriger zu konsumierende Flut von Informationen erzeugt, wird zeifellos dazu führen, daß ständig neue Vorstöße unternommen werden, um dieses Problems durch technische und organisatorische Maßnahmen Herr zu werden. Und es kann meiner Ansicht nach auch kein Zweifel daran bestehen, daß die sich abzeichnenden Lösungen langfristig zu einer tiefgreifenden Umgestaltung des Umganges der Menschen mit Informationen jeder Art führen werden.

Wie diese jedoch aussehen werden, wird im rationalen Bereich durch das Wechselspiel zwischen technischem Angebot und anwendungsorientierter Nachfrage und im psychologischen Bereich durch das zwischen "Entlastungserwartung und Nebenfolgenangst" entschieden werden. Ob bzw. wieweit z.B. ein Archiv auf elektronischem Wege

auf einen Heimarbeitsplatz projiziert werden kann, hängt weniger von der Technik ab als vielmehr davon, ob eine solche Verlagerung von Arbeitsplätzen in die privaten Wohnungen und in das Familienleben, - mit allen Kosequenzen auch für die damit verbundene Verlagerung personeller, räumlicher und zeitlicher zwischenmenschlichen Kontakte, - mit den zukünftigen Gegebenheiten von Heim und Familie verträglich ist.

Ihnen meine Damen und Herren, die sie bisher die Vermittlerrolle zwischen gespeicherten Informationen einerseits und den Benutzern andererseits innehatten und - das ist meine feste Überzeugung - diese auch in Zukunft innehaben werden, kommt bei der geschilderten Entwicklung ein besonders hohes Maß an Einfluß, und damit auch an Verantwortung zu. Dies gilt sowohl für die technische Seite als auch für die anwendungsorientierte.

Und hier habe ich zum Schluß, - auf dem Hintergrund des alten Sprichwortes, daß alle Theorie grau sei, - eine Bitte an Sie: Scheuen Sie keine Experimente! Nur sie können uns letztlich Hinweise vermitteln, welchen speziellen Weg die Entwicklung des Informationswesens unter Berücksichtigung aller Aspekte, nicht nur der technischen und ökonomischen, sondern auch der sozialen und anthropologischen vernünftigerweise gehen sollte.

Ich danke Ihnen für Ihre Aufmerksamkeit!

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Joint Seminar: The Impact of Technology on Libraries

Section: Information Technology
Social Science Libraries
Biological and Medical Sciences Libraries

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Some Possible Future Effects of Information Technology

by

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SOME POSSIBLE FUTURE EFFECTS OF INFORMATION TECHNOLOGY

Maurice B Line

One of the problems of giving the last paper in a series is that most of what needed saying is likely to have been said already. This is particularly so when the title is a general one. I can only hope that any points I repeat are worth repeating and that any additional points I make are valid. The topic is in any case such a huge one that I can only present a personal selection of a few themes.

Information technology is already changing our lives in various ways. Some of these are desirable. IT helps to make human communication, and indeed many activities that require human beings to work together, independent of distance, so that large conurbations and large industrial plants, with all their problems, are no longer necessary. IT relieves us of a great deal of hard, dirty and repetitive work, both physical and intellectual. IT gives us more control - over the natural and the man-made environment. At the same time, IT opens up new possibilities of intellectual stimulus.

These advantages are double-edged. Much work may be unpleasant, but it may be better than no work at all; most people would rather work at boring or unnecessary tasks than be idle. It is noteworthy that many of the activities people choose for their leisure are activities they would resent if they had to do them as part of their jobs; they are often labour-consuming and energy-consuming, and this is part of their attraction. We are told that IT will create new jobs, and this is true, but it is hard to see how they can possibly replace the large numbers of mechanical and clerical jobs that are already being lost.

The ability to operate in small units, even as individuals - in effect, to work and play at home - could lead to a further reduction in social activities. As for the control that IT

makes possible, who is to do the controlling, and for what purpose? The dangers of abuse are all too obvious, and very difficult to guard against; once information is stored, in massive files from which fast retrieval is possible, how is it possible to ensure that it is not used to wrong ends? Control may be good for the controllers, but not necessarily for the controlled. This applies to control over the environment as well as over people. It applies also to control over published documents: a great deal of interesting and damaging information could be obtained from an analysis of published documentation. The power given by IT is frightening.

At the same time, IT can be used to alleviate some of its ill effects. IT could make a huge contribution to leisure - not by trivial means such as video games, but by using communication facilities to the full and using also the computer to help people develop and exploit their own imaginative and intellectual capabilities. IT can aid continuing self-education. IT can make it possible for the governed to obtain far more information about their governors, local or national, and to put their own information into a government system in a way few individuals have the opportunity to do at present: their input into the democratic system need not be confined to occasional votes in elections and at referendums. Since the governors can always be one step ahead of the governed, continuous vigilance and effort are needed to ensure that IT is used for positive and good social and political ends.

As well as these more general effects, IT will change our concept of information. Librarians at least have tended to equate information with recorded knowledge, but this position will become increasingly impossible to maintain. In the first place, more and more information will be transmitted but not recorded. Secondly, the recording of information will no longer always be in the fixed forms to which we have been accustomed - the printed page, the gramophone disc, the film - because electronic stores are amenable to change. Our attitudes to

national archives of recorded knowledge will have to change; and if libraries are not to have a diminishing role as information communicators, they will have to devote less attention to storage and more to transmission. It will take us some time to adjust to the concept of recorded information as fluid and changeable.

Others besides libraries will be involved in the storage and transmission of information, and the boundaries of the library's role - where a certain type of information or communication becomes someone else's business - will be very hard to draw. This is not only because of shifting definitions and concepts, but because of a growing involvement of the private sector in information handling. Most libraries other than small ones in most countries are supported, directly or indirectly, from public funds, and over the years a balance between library and non-library sectors, between the public and private sectors, has been reached. In general, the private sector produces recorded information and the public sector buys it in order to make it available to the individual consumer. It is in fact more complex than this, because much of the information provided to the private sector - the publisher - has been produced at public expense (government research grants etc). Without free input and the library market the publishers of scholarly and scientific journals could not survive. This suggests that the balance should be disturbed only after the most careful consideration of the possible consequences.

Nevertheless, the balance is being disturbed. We are all familiar with reported statements from publishers, based at best on a gut feeling that 'free' photocopying is damaging journal sales and/or ought to be paid for anyway to keep journals alive. One of the motives behind the drive towards the electronic storage and transmission of articles is the desire to make free use impossible, since control of electronic stores is largely in the hands of their producers or operators, and access is possible only on their terms. (This is not strictly true, since

electronically transmitted information can be loaded on to local stores and used again subsequently, but this is much more obviously an act of piracy than the making of a photocopy, and heavy penalties could be expected for any malpractice). Most of the articles in most published journals are of no interest to the institutions that buy them, and libraries could be strongly tempted to acquire articles on demand; this could kill off the printed versions of some journals - I do not share the publishers' belief that there is a double market. It could also lead to a market economy for articles - that is, their acceptance could depend on an estimate of their likely use rather than on their quality. Any attempt by publishers to bypass libraries altogether and transmit direct to individuals could achieve similar results. I am not sure that publishers have fully thought through the possible consequences of electronic storage and transmission, though their ventures into this new territory are cautious enough to allow the possibility of retreat.

The considerations above apply with more force if other bodies than traditional publishers become involved in electronic storage and transmission. The investment required is very large and it can be afforded much more easily by big firms with some existing involvement in the appropriate technology. There are already signs that some firms with no previous publishing experience but with capital and the willingness to risk it are going into this area. The consequences could be extensive, and rather alarming. The concern that most publishers have shown for the value of recorded knowledge might be sacrificed to purely commercial considerations. Once taken over, the publishing industry could be eroded or changed beyond recognition, and salvage could become impossible.

In my 'bad' scenario of a market economy for scholarly and scientific publishing, many, perhaps most, papers that go into the system at present would not be accepted. What would happen to them? Storage in local files would be a poor option, because

there would be little or no quality control, and a sort of union list of contents of local files would need to be compiled. National files present a better alternative. Quality could be controlled by voluntary referees, indexing and searching would be fairly straightforward, and the cost might be borne by the scientific community as a service to themselves, or financed by contributors who would pay for input and users who would pay for access, though this could penalize poorer authors and users. We might then see two systems: an 'economic' system controlled by the private sector and an 'uneconomic' system in the public sector.

Intermediaries will become important in primary publishing, in the same way as data-base operators are already of major importance in the handling of bibliographic files, since publishers will not wish to maintain their own files for direct access by users. Many libraries have an important role at present as intermediate suppliers, whether they are large research libraries that inevitably receive a high proportion of interlibrary demand or dedicated facilities like the British Library Lending Division. Here again there may be a clash between private and public sectors. If a central faciltiy were privatized, it would be uneconomic for it to handle any but medium- or high-use journals, and the remainder would have to be sought from other libraries or become unobtainable.

What is happening is that information is being seen more and more as an economic commodity, with every use being paid for and every cost being recovered by the producer or supplier; and that electronic storage and transmission make this much easier to achieve. Logically, the originator of the information should be repaid by the publisher; and since originators are more or less the same people as consumers they (or the bodies that fund them) should at least pay no more than they receive in total. If this happened, the whole process of publication and transmission could rapidly become uneconomic unless all information were transmitted through libraries, which would have to pay charges

that were high enough to keep the system going. They could hardly afford to do this without substantial additional money. Since this could only come from public funds, there would not in the end be a market economy.

It is easy to reduce an apparently logical position to absurdity, but it does seem to be that some seemingly rational statements of publishers and others in the private information sector contain inherent absurdities and contradictions. If they want a fully economic system, they should realize that a fully economic system could ruin them as well as damaging libraries and users. If however they will accept that the whole structure of the publication and dissemination of scientific and scholarly information depends on maintaining a balance between public and private sectors - maybe a slightly different balance from the present one, but a balance all the same - it should be possible to reach some accommodation acceptable to all parties. Because of the danger that traditional publishers may gradually lose control to others, it must be in the interests of publishers and libraries to work together to a common end; this requires open minds on both sides, a willingness to work on facts rather than prejudices, and foresight as to the possible results of different lines of action.

A further consequence of the combined trends of treating information as an economic commodity and handling it electronically is that the gap between rich and poor users would increase. The gap between developed and developing countries, and within countries between privileged and unprivileged users, is already huge, but printed material can penetrate to most places. Increased costs of access and the need to use machines to obtain the information at all could make electronically stored material virtually inaccessible to all but a very few in less developed countries, thus further damaging their prospects of technological and economic progress. This particular problem could be partly alleviated by the distribution of printouts from national centres, though it would be unfortunate if no use was

made of the ability of electronic technology to transcend national boundaries and avoid all of the customary delays in the supply of documents.

It is easy to assume that while IT may profoundly to alter the form in which books, reports and articles become available, it will have effect on their structure, except that they can be amended and updated easily. However, unless all documents are printed out at the receiving end, on-line viewing will impose various constraints on the reader. The size of the screen, the difficulty of doing the quick visual scan of an article that is often sufficient to reject it or extract its important parts, the inability to work with two or three papers at once and other factors lead me to conclude that articles as at present structured are unsuited to on line reading. A better structure would be one that simulated and aided scanning and permitted focussing on particular parts as required. The title could be followed by an abstract, then by conclusions. The text, which would have to be tightly organized, would consist of several sections, each with its own subtitle and summary; a list of subtitles would be displayed, and summaries called up as required, followed by full text if needed. (Such a a structure could actually benefit printed texts, many of which are poorly constructed). Experiments with articles restructured along these lines have recently been carried out in the United Kingdom in association with the BLEND project.

Books, although many of them are now printed from computer tapes or discs, will be the last publications to 'go electronic', apart from such works as encyclopedias and handbooks, which are ideally suited to electronic storage and access. They may never become available electronically; certainly their present nature is much less appropriate to electronic access even than conventional journal articles. However, it is possible to conceive of books not as continuous works of between 100 and 600 pages but as collections of information 'chunks', all indexed and retrievable separately. The composition of the work need

not matter greatly so long as the contents were all readily accessible. It is worth remembering that the lengths of articles and books to which we have become accustomed are the product of the publication system: articles of more than about 25 pages are usually too long for journals, while books of fewer than 100 pages are too short for separate publication - for this reason few works, apart from scientific and technical reports, occupy between 25 and 100 pages. IT could remove these constraints, and with them the customary organization of books. Obviously some subjects (eg scientific and technology) are more amenable to restructuring than others (eg history), but many books in the humanities might be differently organized without serious harm to their contents. Whether they would be 'readable' in our present sense of the term is another matter; but if much reading took place on-line the nature of reading would change, and this change could lead to changes in writing practice.

The dangers of improper control over electronically stored information are obvious enough. Once printed documents have been disseminated, tracking them down and eliminating them is very difficult; but electronic files can easily be deleted or altered by their producers or operators and possibly by others who can find the right way into the system, thus allowing the past to be removed or reconstructed - the kind of retrospective conversion that no democratic state could wish to see happen. If enough prints are taken by users the dangers are reduced, but the prints have to be permanently stored and made accessible somehow. In fact, although an electronic archive has enormous apparent advantages over a paper archive - in space occupied, in physical longevity and in retrievability - the only way to ensure that material is not lost or destroyed or corrupted is to produce paper archives from it.

My final theme is the effect of a 'closed' system on the awareness and absorption of knowledge. We have all been brought up with an 'exposed' system, of visible, eye-readable and often

attractive printed matter, into which we have dipped and from which we have absorbed a great deal of information. To get into an electronic system 'keys' are needed and effort is required. How will the keys be provided in an all-electronic world? The scope for control over access is great enough without the addition of obstacles created in the minds of users by inadequate learning. (It is noteworthy that the guides to most computer systems are in printed form). There are ways of overcoming these dangers - television could help, for example - but the dangers do need to be recognized and guarded against.

It is possible to fantasize about the future at any length, and much literature on the so-called paperless society should be regarded as interesting speculation - library science fiction, perhaps - rather than accurate prediction. It is as easy to construct in imagination an Information Armageddon as an Information Paradise. Most worrying are those writers who believe that because something can be done it will be done and should be done - a sort of technological imperative. There are many things that technology can do that should emphatically not be done. We should get our priorities right. By all means let us consider what technology can do, but let us consider also what we want to be done, whether technology can help us to do it, and what other consequences might follow from the application of technology to an apparently good end. Our interest should be not so much in what is technologically possible, but what is desirable, practicable, sensible, economic and humane. If the pursuit of certain lines of action is likely to lead to undesirable results as well as possibly useful ones, it needs to be considered whether the good outweighs the bad or vice versa. Librarians should be neither enthusiastic and uncritical supporters of all applications of IT, nor should they be passive and helpless observers: they should become involved and seek to influence events.

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OVERVIEW - THE IMPACT OF TECHNOLOGY ON LIBRARIES

by

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This joint program is concerned with the impact of technology on libraries. The "impact of technology" can be observed from two points of view. We could reflect on the impact of technology on the various operations of a library, that is, acquisitions, cataloging, reference, circulation, interlibrary loan, etc., and discuss these functions with respect to increased effectiveness for both staff and clientele. Secondly, we could concentrate on the impact of technology on people, both staff and users, and their environment. We could then consider such issues as the competencies needed for tomorrow's information professional, managing change, psychological and medical factors, new physical facilities, economic and political implications, and so on.

It is the latter impact that we had in mind when the Division of Special Libraries and the Sections on Information Technology, Biological and Medical Sciences Libraries and Social Sciences Libraries joined forces to present this session on "The Impact of Technology on Libraries."

It is timely that such a session be held at an IFLA general conference. Where better affirm the positive and negative results of technology in order to understand future requirements and thus design and implement more efficient library systems?

Information and communication technology, albeit young in years, is moving at a pace that makes what took place during the past twenty years seem almost ancient.

The technology with which we are concerned during this program is not limited to maxi, mini, and micro computers and their peripheral devices, for example, terminals and printers, but includes data transmission techniques, laser technology, optical and video disc technology, etc.-in fact, whatever newer technologies provide that can be used in the environment with which we are concerned. Technology per se is not the primary topic of the program, but rather its impact on the library environment.

The program is divided into four sessions. My objective is to give an overview of the content of the substantive papers. Although I knew the themes assigned to each of the speakers when preparing this overview, I had read none of the papers. This is both a disadvantage and an advantage. The disadvantage is that I cannot be certain that I will match the approach that the speakers will actually take toward their topics. The advantage is that I can address subjects more generally with fewer constraints.

As we move from typewriter to terminal to record data, as we move from card and book catalog to terminal to retrieve data, as we fondle a terminal instead of a book to read data, what is the impact on people, equipment and library buildings?

As in the case of other professions and businesses, libraries are concerned with ergonomic problems. Ergonomics is defined by

Webster as: "of or relating to biotechnology" which in turn is defined as: "the aspect of technology concerned with the application of biological and engineering data to problems relating to man and the machine." 1/ However, in the literature, the term "ergonomics" sometimes includes and sometimes excludes medical and psychological aspects of the problem. Regardless of terminology, it appears that the two aspects are virtually inseparable.

The electronics industry has been investigating the human factors of the man/machine interface for some time. For example, how should terminals be built for the most efficient use by human beings? Should the furniture of work stations, that is, chairs and tables, be modified for the "electronic office worker?" It is becoming increasingly obvious that the office designed for a paper environment will not satisfy the requirements of the electronic age.

With automation has come increased concern for workers' health and safety, especially with respect to the video display terminals which are becoming commonplace. Working with video display terminals may cause temporary physical discomfort, possible health hazards, and psychological stress unless proper steps are taken to prepare staff for change, and to address as a whole all aspects of the change from the paper to the automated environment. A study of potential health hazards of video display terminals by the National Institute for Occupational Safety and Health, published in 1981, concluded that

the video display terminal does not present a radiation hazard but recommended (1) that the maximum possible flexibility be designed into the work station so that it can be adapted to the individual operator; (2) that lighting levels be properly set; (3) that direct and reflected glare be eliminated by one of more methods; (4) that work-rest breaks be taken after every one or two hours of continuous work at the terminal, depending upon the level of visual demands, workload, and repetitiveness of the task, and (5) that those hired to work on terminals should have a comprehensive pre-placement vision examination, that any symptoms be treated, and that a general examination be repeated periodically. 2/

Laboratory studies have also shown that use of terminals may create a biochemical ion imbalance which can result in headaches, nausea and allergies. More research is needed to determine the effects of this imbalance and its prevention.

Thus, ergonomic investigations continue. We are still groping to define the problems in this rapidly changing area and, whatever the results, libraries will certainly be affected.

The need to change the environment in which we work will have an impact not only on library furnishings but also, increasingly, on library buildings. In planning any facilities, every effort should be made to take into account the present and emerging technology.

Given the unknowns concerning the rate of technological change, however, it is extremely difficult to predict when a technological innovation will become an operational reality. One of the challenges of the future with respect to building will be to do the right thing at the right time.

It appears to some of us that to consider a future society that is "paperless" is ignoring the heritage of our past. Libraries have always been responsible, where it is possible to do so, for collecting and making available information from every era of mankind and, regardless of the possibility of recording this information in optical and/or video disc storage, we would most likely want to preserve a good part of what we have inherited in its original form. Thus, library buildings of the future will probably be more complex than ever and include traditional equipment such as book stacks and reading tables as well as terminals with access to computer-based and optical and video disc files.

What is the impact of technology on the clientele of the library? The user of any system, be it manual or automated, will use the system more frequently and more effectively if it is "easy" to use. Card catalogs have been relatively easy to use, because consistency has been developed, at least within a country, in their organization. There are three principal problems with card catalogs, however: (1) as they get large, they become more unwieldy; (2) the access provided is necessarily limited by the physical form; and (3) they are costly to maintain. Book catalogs have many of the same negative attributes.

The automated catalog would appear to be the answer to these problems. However, when the impact of automation on users is analyzed, it is realized that other problems must be dealt with in the automated environment. In a card catalog, the cards and the data on the cards are tangible and legible. On the other hand, an electronic catalog, in which the records and the data in their stored form are neither tangible nor legible, opens up a range of problems not encountered with the card catalog. Users who are not familiar with accessing data through terminals and/or not comfortable with computers will need systems that give them more assistance. The requirements for user interaction are different in the online catalog. Thus, automated systems replacing card and book catalogs should be designed so that we do not substitute a set of psychological and physical obstacles for the problems of manual catalogs.

Automation is expected to provide greater access to information. Thus, the danger of providing "too much" information to users becomes still another concern. The theory of cataloging results in various screening mechanisms so that users obtain the most useful data for their needs and, at the same time, avoid data that is unimportant. Librarians have carried out many studies balancing recall (number of retrievals) against relevance (number of retrievals relevant to the needs of the users). If the mechanisms for selecting relevant information now provided are abandoned for more generalized access, how will this affect the proportion of non-relevant material which the user will receive?

As personal computers become more common, data will also be accessible to users in their homes or offices, making it unnecessary in many cases for them to go to the library in person. What will the impact of this be on library staff, on the organization, operations, and services of libraries?

If the library becomes an electronic information center, what will become of such programs as story hours for children, film showings, lectures, etc.? All the programs which involve gatherings of people may be subject to change and this social aspect of the library must be given serious thought.

Also, the cost benefit of electronic access to material, in comparison with manual systems, must be considered. It is frequently stated that the costs of electronic access are greater, but that many more services are provided by the automated systems with only small increases in costs. Can the user pay for these extended services? In the United States, direct payment by users for electronic information services is being debated--controversial in the library environment where the use of libraries has traditionally been "free" to clientele. Someone ultimately pays for all library operations. In a time of economic hardship, the costs may be greater than the benefits.

What will the librarians of the future be like in comparison with those of today? We already know that, regardless of the aspect

of librarianship one specializes in, for example, administration, technical processing, or reference, there must be a concentration in training for technology. In the United States, a great deal of thought is going into the curriculum of librarianship, and most schools have changed their names from the "School of Librarianship" to the School of Librarianship and Information Science." If we hypothesize that the clientele of libraries will work from their home or office and no longer use the physical facilities of libraries as they do today, will this impact the staff of the library? Will they also be working outside of the library? It has been suggested that a significant percentage of library school graduates within the next twenty or thirty years will be self-employed, contracting their servies to organizations or individuals to perform special searches or other services. Whatever the future, the library schools of the future will undergo significant changes.

Which brings us to the economic and political implications of information and technology.

It is already a truism that the industrialized societies have entered the "information age." In the United States, as early as 1967, some 46% of the Gross National Product was derived from information and knowledge-based industries. Today that percentage is probably closer to 66%. Daniel Bell has referred to this stage as "post-industrial society," and it is clear that, while certain countries may be further along in this development, many others are following the same path.[3/]

The economic and political effects that this change is causing are still poorly grasped. The characteristics and behavior of information as an economic commodity have not yet been fully understood. Because information differs from other kinds of commodities in that it cannot be "taken away" from someone or "used up," it must be looked at differently.

Within countries that are becoming post-industrial there has developed unavoidable dislocation on the part of those with vested interests in more traditional industries with economies based in older technologies, sometimes resulting in social and economic tensions. Some authors see this as futile resistance to the inevitable change overtaking these societies.

For non-industrialized countries, the dilemma is whether to steer public policy in the direction of a post-industrial, information-based society, or whether traditional agricultural or industrial models are preferable. A combination approach is seen by some as a means of avoiding some of the social and political problems that have in the past accompanied attempts to industrialize. A highly developed telecommunications system, for example, might reduce the need for more expensive transportation systems.

The requirements of the information age will produce competition among nations for available data transmission slots. Frequencies

that can penetrate the atmosphere are rare, and orbital slots and frequency allocations may not be available for all countries.

One characteristic of information-based societies is that information technology seems inevitably to breed even more information technology. Particularly in the area of knowledge services (of which libraries are a part), advances in technology and organization are increasingly required in order to collect, access, and organize the information generated by other advances in technology.

Increasingly, both industrial and non-industrial countries have become concerned about the large amounts of data, that is, personal data on their citizens, commercial information, and national economic data, that are being processed and stored in automated information systems outside their own countries. Many countries are erecting barriers to the flow of information.

All of this is happening at the same time that libraries under the programs of Universal Bibliographic Control, Universal Availability of Publications, and International MARC are concerned wtih resource sharing and free flow of information.

New technologies also have created great difficulties in the application of traditional principles of copyright. Copyright was intended to foster the creation and dissemination of intellectual works for the public welfare and, secondarily, to give creators the

reward due them for their contributions to society. New technologies and media threaten to cause irrevocable loss of control over copyrighted works because of the easy replicability of information. The locus of potential copyright violation is gradually moving from the publishing house, library, and photocopy center to the home, where the individual consumer may be asked to consider copyright issues and refrain from taking advantage of new technology in ways that violate the legitimate rights of authors. In addition, the concepts "intellectual work" and "fair use" themselves have become muddied.

During the last decade, we have witnessed a continuing increase in the rate and kind of change in libraries. Changes in organization make people uncomfortable, change necessitates retraining, technical change brings into the library a whole new breed of technicians that our managers must manage, old timers are not happy, and "new timers" are impatient with the old. Technical people often relate more to the goals of their technology than to the goals of the organization. The marriage of the computer with telecommunciations, augmented by microcomputers, video and optical disc, and advanced communications systems, is making profound changes on every aspect of a library, and in turn on all its staff.

The managers of libraries have a vital role to play in guiding their organizations through the process of this continuum of complex changes.

During this program, our speakers will undoubtedly assess today's technological environment as well as attempting to foresee the future. They will not always be accurate in their predictions. As Alvin Toffler, author of The Third Wave and Future Shock said, "Nobody knows the future now. We just anticipate as best we can." 4/

It is interesting, however, to try to predict what the twenty-first century will bring, while allowing our imagination free flow. The ideal future would be to have a fully implemented technology without negative fallout. But this is not to be. Experience has demonstrated that all critical negatives cannot be avoided but are eliminated in an evolutionary process wherein at each stage we discover what we have done wrong or what we may improve. This process continues as we seek, but never attain, perfection.

Notes

1. Webster's New Collegiate Dictionary. Springfield, Mass., G. & C. Merriam, 1979.

2. Potential Health Hazards of Video Display Terminals, by William E. Murray and others . Cincinnati, Ohio: National Institute for Occupational Safety and Health, Division of Surveillance, Hazard Evaluations and Field Studies, 1981. For sale by the Superintendant of Documents, U.S. Government Printing Office, Washington, D.C., 20402: 68-72.

3. Naisbitt, John. Megatrends. New York: Warner Bros., 1982: 11-38.

4. Neill, S.D. "Libraries in the Year 2010: The Information Brokers." The Futurist 15 (October 1981): 47.